COMMERCE AND INDUSTRY

NEW EDITION

BY

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NEW YORK
HENRY HOLT AND COMPANY

November, 1927

PRINTED IN THE
UNITED STATES OF AMERICA

PREFACE TO NEW EDITION

We face a new world It might almost be said that every year is the world made new. Name over the epoch-making inventions that have become effective in the time of your memory, and you will see that they are coming faster and faster The age of science and inventions seems to be in its beginning, not its ending. All these new things react on each other, on our natural resources and economic situation and give a new and changed usefulness to our old earth Never before did we have so many good reasons for needing to know about this world which is our home Each year an ever-widening part of the earth influences nearly every home upon it.

This book is an attempt to explain how the earth becomes the home of man especially those men who are pleased to call themselves civilized

How does climate affect man? How does the soil feed him and furnish him materials for shelter, tools, heat, power and industry? How do the form, location, and surface features of the land affect his efforts at trade? How are these things affected by the new powers given by science, the new devices made by invention? These questions, whose answers form so large a part of economic and commercial geography are of great importance in education and especially in vocational courses. In giving these explanations of the earth, I have always tried to answer the natural question "Why?" Therefore I have had to tell fewer facts in order to leave space for the explanations This makes less to remember and more to understand The book aims, therefore, not to be a mere catalog of facts and statistics The more important facts are there, but the important thing is that the meaning and causes of the facts are set forth as vividly as possible. *The physiographic influence in industry is not given in a separate formal statement at the beginning of the discussion of each country, but is treated in connection with the industrial fact which is being explained.* Thus, in showing how wheat

happens to be grown in a given region, we are explaining both wheat and the region—bringing cause and effect together. This may properly be called the *applied science method.*

More than half of the book is devoted to the United States. Of foreign countries, Latin America and the Orient receive more than usual attention because of our coming trade expansion with those countries. In the part of the book dealing with the United States, I have described industries rather than regions or states. The wheat industry, for example, arises from certain environmental conditions that exist in many states and many countries. Therefore I have sought to refer, by way of comparison, to the great wheat-producing regions in other countries. Thus the industries of the United States are treated in their world aspects, permitting a briefer and more local treatment of the same industries in the part of the book devoted to foreign countries. Wherever possible, comparisons have been made between countries and regions. As a result of this method the chapter on a given country does not contain all the information in the book about that country. Those who wish to collect all the information the book contains about any topic are referred to the alphabetical index, which is unusually full.

A statistical appendix is also included for purposes of reference. A great amount of work has been put upon collecting and compiling these figures to make them as instructive as possible, but there are certain inexpensive current sources which should be within reach of every class that is interested in following the current trend.

The publications of certain government departments in Washington, D. C., constitute a very useful desk collection of first aids to the study of geographic and economic principles. Those meriting especial mention are listed at the beginning of the statistical appendix.

The third part of the book deals with world trade routes and the laws of trade—and contains certain generalizations that can be appreciated only in the light of such facts as are set forth in the preceding sections of the book. In this section also I have discussed some possible future developments such as the great increase of our trade with the tropics, the utilization of the hills of New England and the semi-deserts of Arizona through tree crops, the improvement of farming in the South through diversification; the extraction of nitrogen from the air; the utilization, as coal and

oil fail, of water, wind, tide, and even the sunshine itself as sources of power.

I wish to give the most hearty acknowledgment of the months of work by Mr. Howard H. Martin of Columbia University in cooperating with me in the remaking of this book and in reading the proofs.

J. R. S.

COLUMBIA UNIVERSITY,
NEW YORK CITY,
March 17, 1925.

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COMMERCE AND INDUSTRY

INTRODUCTION

OUR CHANGING ENVIRONMENT

1. THE SIZE OF AND KINDS OF OUR ENVIRONMENT

Man's small share of the universe. A certain tribe of microbes is said to live only in the tiny crack of space that lies between the surface of our teeth and the film of moisture that clings to them. Outside of this space the microbe is like a man traveling through a fiery desert or an icy waste. This film home sounds like a very small place in which hosts of beings must be born, grow, and produce their young, but when we look at our home space, we can see that man is very much like this little enemy that sends him to the dentist. It is a very tiny part of the universe that must serve as the home of man.

Look at the limitless space that astronomers call the universe. Thousands, perhaps millions, of suns float through it, some of them larger than our own sun. One speck of this vast realm is our little solar system, our vast sun with eight planets swinging round it and warmed by it.

An English scientist has called our earth a "second-rate satellite of a fourth-rate and moribund star." But so far as we know this planet is the only place where men could live in all this vast universe of worlds, even if we could freely visit every part. Further, we certainly know that there is a very small part of this, our own world, on which we can live. No man has been 500 feet beneath the surface of water and lived. His deepest mine has penetrated only about 4,600 feet below sea level, or less than a mile toward the center of the earth. The greatest height man has been able to climb in an airplane is only seven miles above the level of the sea. Our new-found ability to fly costs enough effort, cash and danger to show us that after all we must spend most of our time crawling about the surface of this world. We cannot go much below or much above that surface.

Few parts of the earth are good. Yet further than this, examination of the earth's surface shows that within this little narrow surface belt, which may indeed be likened to the microbe's home in the film of a tooth, most of the area for one reason or another does not seem to be a very good place for us to make our homes. Three-fourths of it is water, some of the land is too hot, some of it is too cold, some of it is too wet, some of it is too dry, some of it is too high, some of it is too stormy Thus we find that because of the varied goodness of the earth as home for man there are few places where men are many, and many places where men are few.

Recent discoveries. The nineteenth century was one of large explorations and speedy conquests of the earth. Men established trade on all seas, in all continents Tremendous new inventions gave us powers over material things such as men had only thought of before as material for fairy tales. This new science, the new industry, the new machines, the new railroads, steamships, this world trade, helped the nineteenth century to increase the people of the world from 1,000,000,000 to 1,600,000,000

Social order or chaos. Four thousand years before Christ the Assyrians had big cities on the banks of the Euphrates and Tigris rivers in the rich plain of Mesopotamia They had schools, libraries, banks, transacting business much as our banks do Then came anarchy and marauding bands, but hundreds of years later the Persians restored order. Their roads, mail carriers, commerce, peace and prosperity reached from the Ægean Sea far in the highlands of Persia. Their empire also fell to be followed later by similar periods of prosperity, commerce, culture, art and civilization, under the Greeks, the Carthaginians, the Romans and the Venetians.

The biggest facts of history are (1) that in periods of order we may have wide-reaching civilization, (2) that in periods of anarchy we with difficulty have civilization at all and (3) civilization and anarchy have succeeded each other for thousands of years, giving social environment that ranged from good to very bad. The most important single question facing us is this: can we keep our civilization from following the common lot?

Our new-found ability to have world trade gives us a new interest in world order or world peace. World trade means that

each people needs access to all the earth. With world trade Belgium became populous. With a blockade during the World War that shut her off from the world she would have starved but for the Belgian relief. Russian Armenia, a little 20,000 square miles of territory, south of the Caucasus Mountains, east of the Black Sea, had bought its agricultural machinery from Germany before the war. Five years of the blockade and war reduced Armenian food supply to the point where 140,000 people starved within a year after the armistice because they could not resume trade and in December, 1919, hundreds of thousands faced starvation and were only saved by money from the United States whereby they might get food to carry them to the next harvest and plows and seed to plant a crop and resume their life as farmers.

World environment and world citizenship. Let us assume that men will have intelligence enough and fairness enough to build up shortly some kind of a world organization that will keep world order and reasonable justice among men. Prosperity will then come to Belgium and Armenia and China and every other country where people are willing to work. Increased trade will make every country more and more dependent on many others The age of national independence is gone; we have for years been in the age of national interdependence, more and more we are becoming citizens of the world, in spite of ourselves. The only way we can escape it is to live the life of hermits clothed in bark and the skins of wild beasts

If we are to have a new world-environment through a new and enlarging world trade it becomes all the more important to know the physical environment, the basis of this trade, as it shows itself in the fitness of the different parts of the earth as the home of man

The value of lands to man. The earth becomes the home of man by furnishing him food, clothes, house or shelter, fuel, luxuries, and tools and materials of industry which enable him to produce and transport goods. So nearly universal are these wants that virtually all men have all six classes of goods Even savages have luxuries in the form of toys, ornaments, and musical instruments. Each particular method by which a man gets some useful commodity leads to an industry often of world-wide distribution.

All these materials for a living come directly or indirectly out of the crust of the earth. Most of our goods come indirectly through the intermediate stages of plant and animal life, the earth itself supplying directly but a small part of our wants. The plants grow from the earth. We cut them into pieces, shape them into tools, and build our houses and barns. We eat them

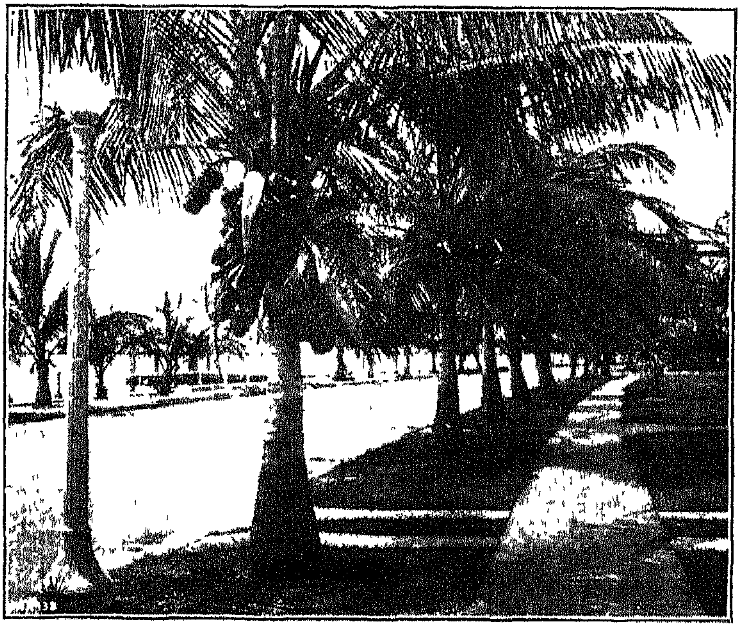


FIG. 1.—The cocoanut, one of the great food resources of the tropics, shades the streets of Florida cities.

or clothe ourselves with their fibers, we extract their juices and dig their roots for drugs and medicines. We burn them for fuel, turn them into articles of luxury, and thus make them help to supply some of the wants for each of the six classes of goods. The animals in turn eat the plants and each other, and furnish us their meat and milk as nourishment; their wool and furs become our clothing; their skins make our shoe leather, the tents of the nomad, the belts of the engine wheel, the bindings of our choicest books.

2 The Influence of Climate

Climate and civilization. To understand how the earth supplies our needs, we must first consider climate. Climate decides the way in which a land produces what it produces, and whether men shall be healthy or unhealthy, lazy or vigorous, many or few. The land and the climate make the physical environment, and the environment permits the products and makes

Fig. 2 —The Jamaica negro finds life in the tropics to be easy. (Hamburg American S S Co)

the man and the race. If the climate is too cold, there can be little growth of population, as in Greenland, and if it is too warm, there is much growth of plants, but little progress in man, as in Borneo, New Guinea, or the Amazon Valley Civilization is a product of adversity The great civilizations of all time seem to have arisen where nature made production possible only a part of the year, and thus made it necessary for man to work and save up for the time when he could not produce

Effect of tropic abundance. Accordingly, there have been no great civilizations in the warm, moist parts of the torrid zone

(Fig 3), where nature does the most to make easy the support of life The climate is continually warm, and the rainfall is sufficiently regular over vast areas to keep vegetation always green and growing A few banana plants by the hut, and a little

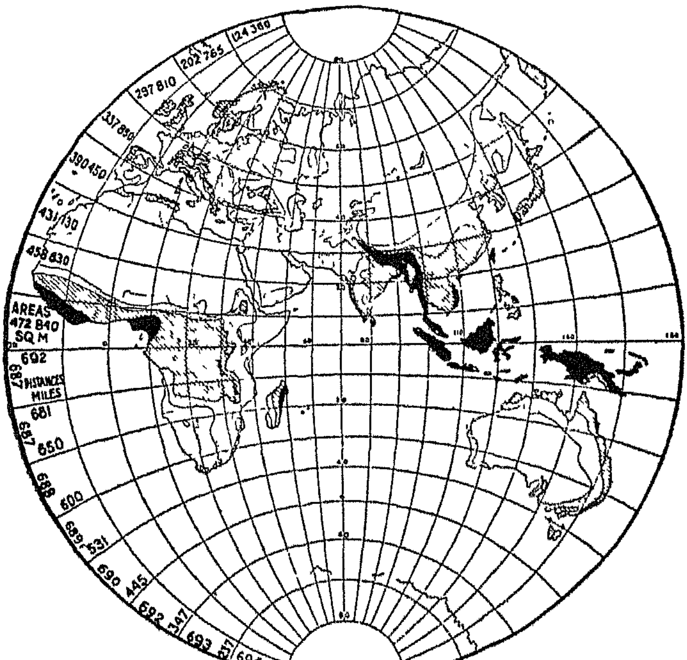


Fig 3 —World rainfall, annual. (After Mark S W. Jefferson)

Very heavy—an annual rainfall, including melted snow, of over 80 inches
Heavy—an annual fall of from 40 to 80 inches
Light—an annual fall of from 20 to 40 inches
Scant—Less than 20 inches in the year

Note the rainfall and heat in regions of high development of civilization. Compare this with Fig 4.

patch of sweet potatoes will live and yield for years, for there is no frost to kill the plants. The forest is full of nuts, wild fruit, and game, the streams are alive with fish. Wood in abundance

supplies the little fuel man needs for smudging, drying, or cooking, and if he would make himself a drum or any simple tool, the raw materials of the forest lie at his hand in great abundance. A little shelter of palm leaves keeps off the rain (Fig 2), the

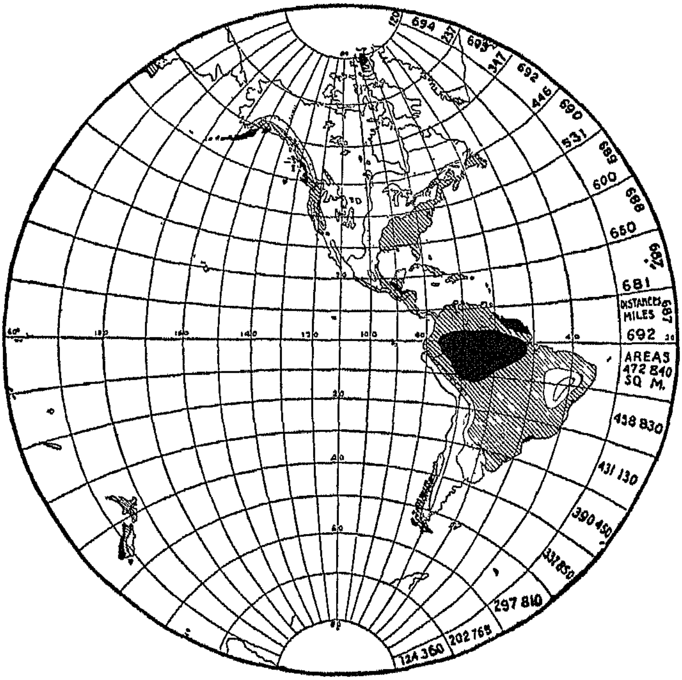


FIG 3 —(Continued)

warm climate removes the need of further shelter or many clothes. Indeed clothes are primarily for ornament. Accordingly, the native of these regions may sit and doze most of the time, as, for untold generations, his ancestors have done before him—enervated by plenty. He does not get the work habit or become ambitious. For this reason lands of perennial plenty have never been lands of political or large economic power Most of them are still in "the forest primeval," and ruled or claimed by the energetic sons of frosty climates. Thus nearly all of Africa and that

part of Asia within the tropics have been taken as colonies by the peoples of Europe The only absolutely independent territory in all Africa is Abyssinia, where the cool climate of a high plateau stimulates the people into a vigor and activity that has

FIG. 4.—World distribution of population. (After Mark Jefferson)

Grade of peopling	People to 1 square mile.
Very dense	250 or more
Dense	125 to 250
Moderate	26 to 125
Thin	2½ to 26
Scanty	less than 2½

Note the close relation of heavy population and intermittent climate.

enabled them, with the aid of a powerful leader, to protect themselves from annexation by defeating a European army.

Intermittent climate. After our summer (the growing season), our winter's frost and snow bring death or hibernation to the

whole vegetable kingdom, and drive man to the protection of house and warm clothing. In such climates we must either starve, eat wild animals, or eat what we have saved by our work during the summer. Therefore we have worked. A similar but

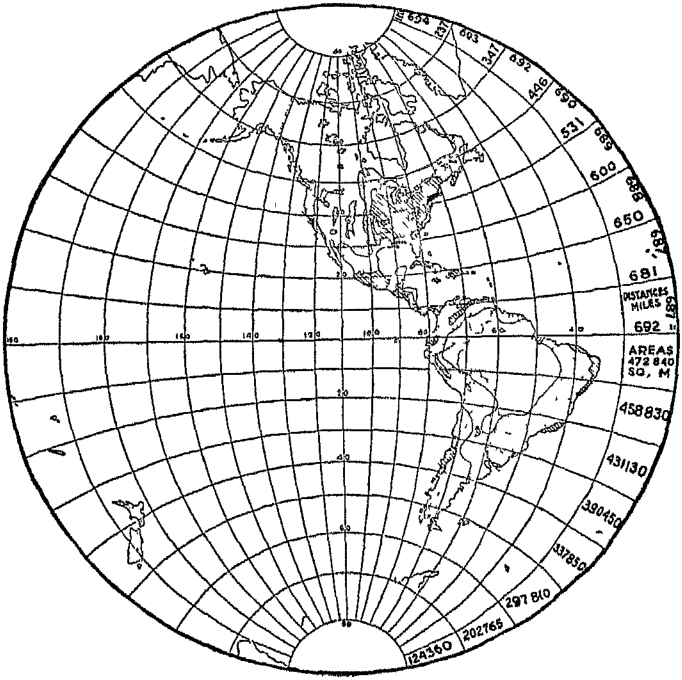


FIG 4.—(Continued.)

less severe climatic goad to man's activity is furnished by climates that are alternately productive and non-productive through variations in the rainfall. The first great nations in the world's history had their empires in the valleys of the Euphrates and the Nile, where a fertile soil and a good moisture supply made great crops followed by blistering drought, a kind of warm winter so far as food production was concerned. Thus Babylon and Nineveh were rich and cultured cities at a time when all Europe lay in barbarism, and the pyramids were built before the

drought-driven Joseph went down to Egypt These valleys got their early start because their advantages as the home of man were almost unrivaled They had a warm climate, fertile soil, and a protected location Each year the rivers overflowed, fertilizing the soil with the muddy waters and promoting the growth of a crop by irrigation The necessity of food to last through the dry season naturally produced the habit of working and saving, and resulted in a sufficient surplus of goods to support life while attention was given to learning, building, and the other things we call civilization

The influence of an unfavorable environment. To an extent we rarely notice, the environment makes the race and makes it do things It is a common mistake of the historian to say that peoples have certain qualities inherently It is much more correct to say that primitive or unorganized peoples are primitive or unorganized, kindly or cruel because of the stinginess or peculiarities of nature's gifts to the land in which they happen to live, and not because of bad qualities which they may inherently possess The environment, in making the race, has given many qualities and has shaped cultures. The Eskimo, upon the bleak, windy, treeless, bitter-cold shore of the Arctic Sea, in a climate where he constantly faces the danger of freezing and starving and where, therefore, he needs much protection from the cold in the form of fuel, clothes, house, or food, has almost nothing with which to build houses, make clothes, or prepare food. Accordingly, the population is exceedingly sparse and supports itself chiefly along the seacoast where the few advantages of the land may be combined with the more numerous advantages of the sea with its fish and seals. Shall the Eskimo be dismissed as a barbarian or praised as a master of a ferocious environment? In winning a living from such meager and almost exclusively animal sources the Eskimo has shown great ingenuity. Even the kyak or canoe, the most complex of his implements of industry, is made of bones and tough skins bound together with sinews and rawhide thongs, unless perchance the ocean currents bring a little drift wood from afar. For fuel, with which they cook their food but do not often heat their houses, they use the fat of the seal, walrus, or whale blubber Yet the Eskimo himself is not a bad, weak, or stupid fellow. His many fine

qualities are highly praised by explorers Upon being put to school he has shown that he can learn with the rest of us The severity and poverty of his environment have made economic progress impossible. A large society cannot be organized without a large food supply

Peoples dependent on one resource. Other peoples have succeeded in living in other countries with almost as few natural aids as are possessed by the Eskimos, and culture has also been held in check. The South Sea Islander has lived on coral islands a few feet above the waves, where his resources were limited to the cocoanut-palm and a few other vegetable products and fish that came from the sea Yet with these limited resources he has managed to keep remarkably strong and healthy and fill in some manner all his needs. When he wanted a saw, he got it by fastening shark's teeth into a piece of wood His other equipment was made by equally ingenious and laborious devices.

Upon the plains of central Asia people have lived for ages in a land where the one resource was grass Flocks of sheep, cows, horses, goats and camels fed upon the grass The herdsmen upon their horses followed the flocks as they roamed the flat plains in search of grass These people were nomads because they had to go wherever they could find grass Their diet was milk, cheese, and meat, and grain obtained by barter at some oasis, their clothing, wool and skins, their shelter, a felt or leather tent stretched over a few precious poles which they had carried with them for hundreds of miles from the banks of some mountain stream Bits of dry dung of their animals made the fire A little metal was bought from trading caravans.

3. Influence of Natural Protection and Beasts of Burden

Two other things have been necessary to enable man to develop a large and wide-reaching cultural group One is beasts of burden to do his work, the other is sheltered localities where he could be free from robbers and danger of conquest Athens and Sparta were in sheltered nooks Rome started on a hill crest easy to defend. The cliff-dwelling Indian of New Mexico, secure in his nest, was more civilized than the Indians of the open and unprotected

Mississippi Valley who were in almost constant warfare. Both suffered from the lack of domestic animals.

4. The Necessity for Commerce

Importance of transportation. It requires a variety of natural resources and of industries to supply the wants of man. This variety may be provided in a small locality or the products of widely separated districts may be brought to one place by commerce. Since many regions have little variety of resource, commerce is usually necessary to get together the variety of things necessary to support us. Commerce is first of all dependent upon transportation. Men can trade without money, and by signs they can trade with a people whose speech they do not understand. The important thing in all commerce is the fact that the goods *can be moved*.

Commerce without the railroad. Without the boat or railroad, commerce is a minor thing and must be so. The horse-drawn wagon enters into modern commerce only for short hauls, as in taking goods to and from the railway or boat. Where commerce depends entirely upon muscle, as the caravan of wagon or pack animals, we have the commercial conditions which made the Middle Ages.

The first long-distance commercial enterprises of which we know were carried on by means of caravans, such as set out from Egypt in the days of Pharaoh, and from Babylon in the days of Nebuchadnezzar. Only the most costly goods are worth caravan freight rates. In lands dependent on caravan trading nearly everything that man uses must be produced in his immediate locality. The high cost of transportation, where commerce still depends on muscle, drives man back almost entirely upon his local resources. In vast areas of Alaska, northern British America, northeastern Europe, northern and central Asia, Africa, and South America commerce is greatly hindered by lack of modern transportation facilities.

Civilization depends upon commerce. Thus the man in a land of few resources, before modern commerce comes, must develop great ingenuity and great power to do without. Such has been the life of the Eskimo, of the Indian, of the nomad (Kirghiz)

plainsmen of central Asia, of the American frontiersman as he went westward and settled in the wilderness The Eskimo's house is made of snow, the Indian wigwam of skins, the nomad

FIG 5—The banana tree Commerce has made this tropical fruit a staple of diet in northern lands (United Fruit Co)

herdsman makes a tent of felt, the frontiersman's house is of logs or turf (Fig. 6). None of these men can get material for any other kind of a house.

Under these conditions man needs commerce badly Without a great deal of commerce no large community can rise save in most favored spots Thus, in the days before steam, civilization could rise only in a few spots with great variety of resource or locations easy of access to ships. The interiors of continents

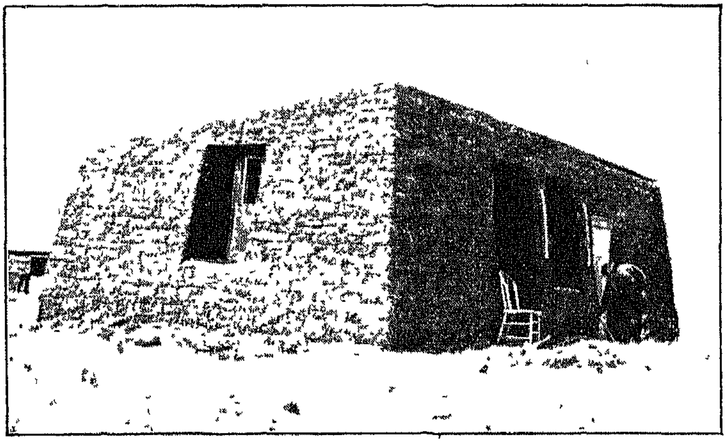


FIG. 6.—Sod house of the new settler on the treeless prairie of North Dakota, built of the resources at hand Commerce has made the minimum contribution to it No wooden house is so warm.

remained practically empty Empty also were most lands of only one resource.

5 THE WORLD MARKET

A new world. Within the last hundred years coal, iron, steam, gasoline and electricity have given us a new world For ages the fight with the cold environment was slow. In recent times it has been most swift The railroad with its accompanying car of coal has emancipated man from dependence upon the local fuel supply furnished by forests, or annual crops as in China, and has permitted a great rush of civilized humanity into cold interior regions such as the Mississippi Valley and the plains of Canada, Russia, and Siberia Instead of the local market, we have the world market Instead of the local environment, we

are coming to have a world environment. The railway and the steamboat make it possible for a backwoods district having but one product in abundance, to supply its inhabitants with all the varieties of goods in the metropolis, because it can sell its one product and buy in return the many different things that the people need When crops are good, the farmers of Saskatchewan or Argentina who sell only wheat, buy goods from a thousand distant factories. They can do this only when a railroad, the most controlling of all factors of commerce by land, comes near enough to make possible the marketing of the grain and the bringing in of manufactures Such has been the history of the settlement of all that vast farm-land plain lying beyond the Mississippi River and reaching from the Gulf of Mexico northward beyond Winnipeg. The heart of Russia and Siberia was pierced by new lines of railway, before the World War, making possible the emigration of the Russian peasants into untilled Asia, as the Americans and Canadians were and are going westward into empty Canada

The railway, the profound changer of man's environment, has not finished its work of spreading into new territories, opening up new lands to trade The environment of mankind is still undergoing this the greatest and most sudden revolution that it has ever experienced. It is the change from the local environment in which the people lived almost entirely on local supplies, to the world environment to which one abundant export commodity admits us, and which by its uniformity tends to make us all alike. Drab uniformity is replacing bright and varied local color throughout this world of standardized goods, phonographs, and radio This world environment creates a world commerce and a world market which we must understand before we can grasp man's relation to any community.

6 World Commerce and the World Market

The staple commodities of the world trade. A world market exists for any commodity that is either produced or consumed over a large part of the world, and is sufficiently portable and durable to permit people in widely separated regions to be interested in buying and selling the same consignments of it. In

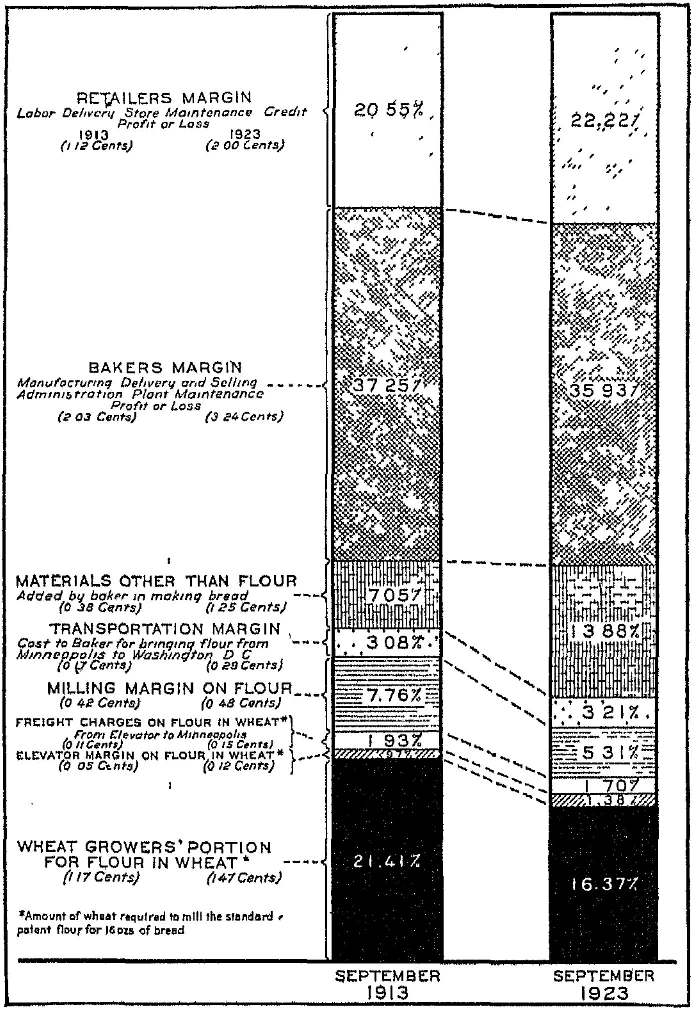


FIG 7.—Distribution of the retail price of a 1-pound loaf of bread in Washington, D C Because of commerce many share in the profits. (United States Dept. Agr)

the days of the sailing vessel, the world market was unimportant, because, with the unsatisfactory, slow, and costly means of communication, only a few valuable and non-perishable commodities could be transported long distances The staple commodities of the world trade and the world market of that day were spices, silks, tea, coffee, furs, and curios made by the peoples of the different races

The staple articles of a century ago are no longer the staples of the great world market True, they are handled in greater quantities than ever, but cheap and bulky goods have now become the staples since all continents have their railroads and all oceans their steamships Thus spices, for which India was once so important, are now twenty-second in her list of exports (1922). A century ago, tea, coffee, and spices were the chief foods on the world market To-day the important food staples are wheat, corn, oats, rice, sugar, beef, pork, mutton, butter, potatoes, apples, oranges, and bananas These are the chief foods of the white race, and, in part, of the other races also.

World trade prevents famine. The fact that staple foods can be produced in the heart of one continent one year and sold cheaply in the heart of another continent the next year means to most of us a comfort and security usually unrecognized, because we have nothing with which to contrast it. We know nothing of famine in America or western Europe in our day, yet two centuries ago it was a nightmare that haunted all peoples If a season happened to be too dry or too wet, or some sudden blight or disease made a local crop a failure, the people of the locality had to go hungry because there was no means of carrying bulky foods any great distance Now, with the swift steamship and the railroad we can prevent famine by bringing in food from across the ocean (Fig. 8) Thus in times of shortage we import wheat from Canada, rice from Asia, and even such bulky goods as meat from Argentina, potatoes from Europe, and oranges from Japan, provided, of course, that we have the money or credit with which to buy Millions of people have starved in India in this century near good transportation facilities because they lacked means with which to buy Millions have also starved in Russia while farmers burned corn in Kansas. This was partly due to crop failure and partly to the breakdown of commercial and social organization.

Changes in world trade during the last century. The world market staples of clothing a hundred years ago were silk and furs—

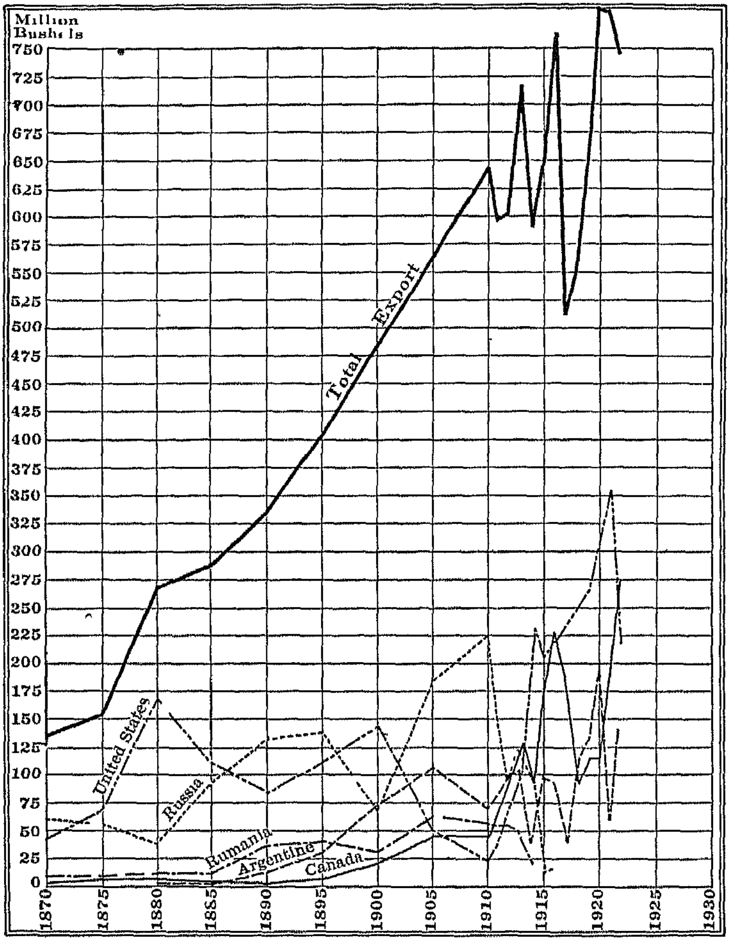


FIG 8 —World export of wheat and flour has increased fivefold in the past fifty years

luxuries for the rich. To-day they are cotton, wool, hides, skins, cotton-cloth, shoes, and hats—the clothes of the masses and of

the poor In almost every schoolroom in the United States is clothing of wool, cotton, or leather from two or three continents. A century ago world commerce brought for the equipment of man in his activities little but lumber, trinkets, and curios To-day there is a world market for iron (Fig. 9), steel, cement, coal, ores, locomotives, machinery, jute, Manila hemp, and other fibers, so that the school building and the dwelling-house usually have

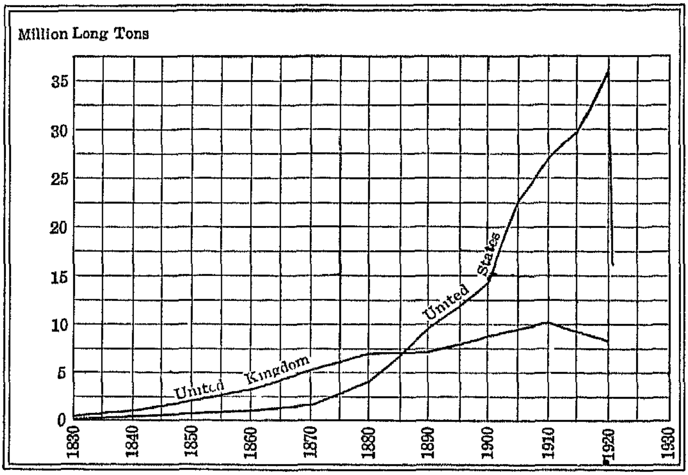


FIG 9—Manufacture of pig iron is considered an index of trade activity The United States and the United Kingdom are the world's largest producers

in them materials that have been carried thousands of miles (Fig 12)

The ability to buy and sell in the world market has quadrupled the population of the western world. It has revolutionized our daily life and our industries. It enables us to take advantage of differences in natural resources and to produce on a large scale for the people of distant states or foreign lands

7 WORLD COMMERCE AND AGRICULTURE

Farming in the domestic epoch. Farming, like manufacture, has been revolutionized by world commerce. In 1786 a Massachusetts farmer wrote a book telling just how he supported his

family[1] With the wheat and corn and buckwheat that grew in his fields he furnished the family bread. The chickens, pigs, sheep, and an occasional beef animal that he slaughtered furnished the meat. His garden furnished all the vegetables and his orchard fence-rows, and pastures, all the fruits, many of which were dried for winter use. The farm produced the family food. For clothing, his wife spun and wove the wool which he sheared from the sheep, and the flax that grew in the corner of a field was made into linen. The skin of the meat animals was tanned and made into the family's shoes. Thus were they clothed. The trees from the wood lot furnished the boards to build the house, the logs for the fire, and the rails for such fences as were not of stone. Like most farmers of that time, he was a fairly good worker in wood, and had a little blacksmith shop, so that he made practically all of his own tools on rainy days and in snowy winter weather. As everything was done at home, we call this the domestic epoch.

FIG. 10.—The spinning wheel furnished man's clothing during the domestic epoch. Commerce has made it a relic of the past.

Only a few things were needed from the outside world, such as salt, pepper, and iron for the little forge. These outside products cost him $10 a year, permitting him to save $150 out of the $160 received for the wheat and cattle that he sold. This completeness of support was obtained by an amount of hard work and discomfort that would not be tolerated in this age of greater opportunity created by commerce and division of labor.

Farming in the commercial epoch. Since the coming of the epoch of coal, steam, and machinery, the farmer, especially the American farmer, sells more and buys more, and his family usually does less work. His shoes and clothes are factory-made, the lumber

[1] See MacMaster, J. B., History of the People of the United States, Vol. I.

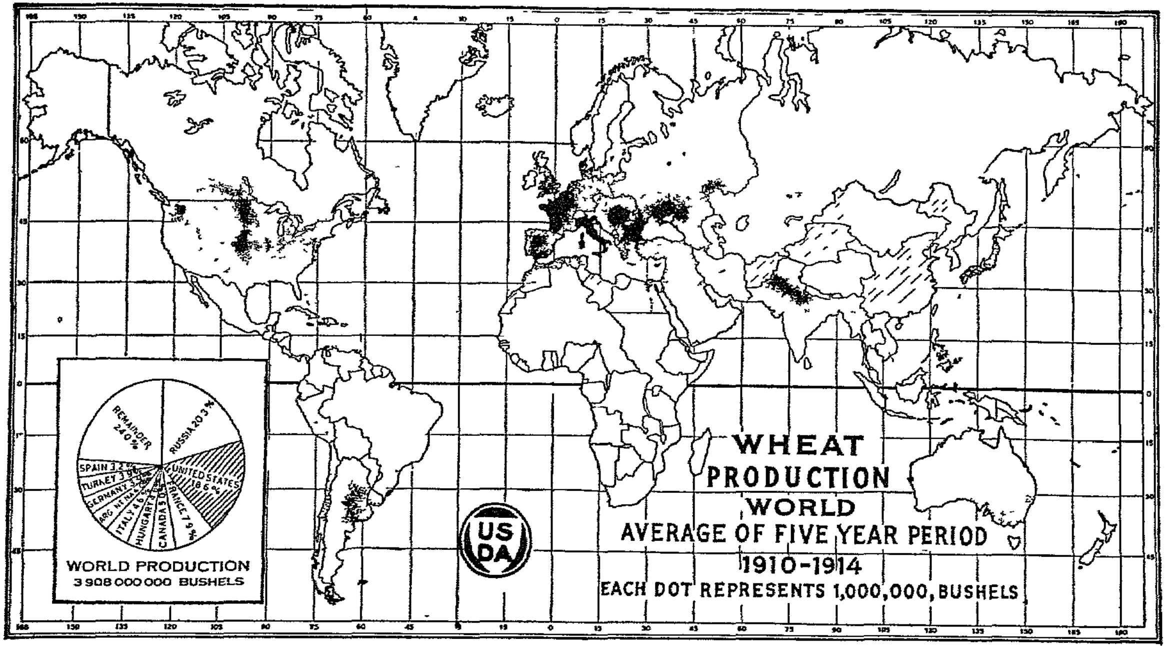


FIG 11 —If we look at the places where wheat is grown and the places where it is not grown, we can easily see that, after all, a large part of the human race has easily got along without it Its importance to us is a matter of habit, but habits in diet, once they are formed, are hard to change

for his barn often comes from afar, as does the coal for his stove and the stove itself, as well as the tools, the wagon, and often the horse that draws the wagon. A much greater farm product is required to support a family by the commercial than by the do-

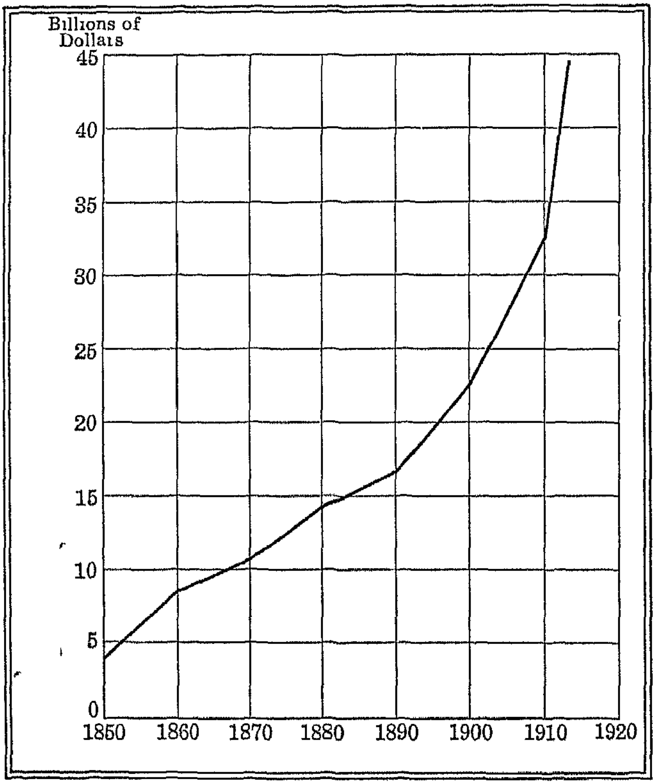


FIG 12 —The growth of world commerce, 1850–1914 Combined imports and exports of foreign commerce of leading countries. A tenfold increase in over seventy years

mestic system. The increased product goes to pay for things not done on the farm. In the matter of clothing, a flock of fifteen sheep yielding 75 pounds of fleece would abundantly clothe a family with homespun. If the same 75 pounds of unwashed wool

were sold at forty cents a pound, the resulting $30 00 would scarcely buy one-tenth as much ready-made woolen clothing. Many thousands of American farms that supported large families

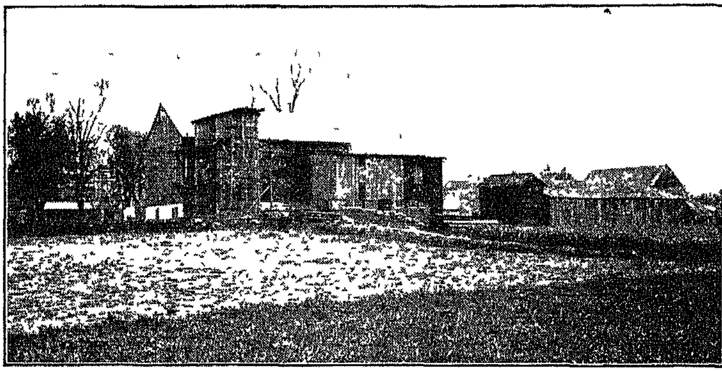


FIG 13 —The frame house, barn, outbuildings, silos, water tank, fences, and machinery of a modern American dairy farm require much wood and iron, often brought long distances Compare with Fig 6 (United States Dept Agr)

in the domestic epoch will not do so by the same kind of agriculture in the commercial epoch, and hence have been abandoned

Money crops and supply crops. In the commercial system, the most important consideration in connection with farming is the money crop Every farm or every farming community has one or more crops which are usually sold and converted into cash, and hence usually called money crops Among the world's great money crops are grain, sugar, animals, fruits and vegetables, cotton, wool, coffee, tea, and tobacco The money crops do not occupy half the land in American farms, for most of the land is devoted to what may be called supply crops, that is, crops which are used entirely upon the farm and are sold, if at all, in some indirect form For example, nearly half of the American farm lands are in grass Some of it the animals eat in summer, the rest is made into hay for winter forage, so that, while important, the pasture and hay are rarely sold directly, but supply the means for producing something else On many farms there may be fields of corn, oats, hay, grass, and rye, yet these are all supply crops contributing to the one money crop of milk, butter, lambs, cattle, swine or horses.

The complete self-support and the well-nigh money-free life of which the Massachusetts farmer wrote 140 years ago, is gone, but a strong trace of it remains in the fact that many things on the farm are still grown for home use. Thus a dollar for the farmer is often as valuable as two dollars to the city man, because he buys many things cheaply where they are grown, in addition to producing many things for home use. It is interesting, too, to note that there is a strong tendency in many places, such as the American cotton and wheat belts, to grow more supply crops than was the practice at the opening of this century. Trade disturbances of the World War brought sore trouble to millions whose "eggs were in one basket."

8. The Understanding of Lands

Industrial factors. In studying lands as the home of man, it is necessary to give close attention to climate, and to give much

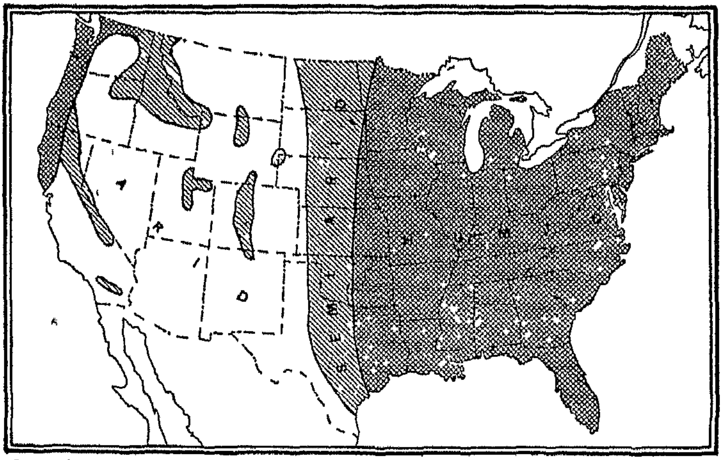


Fig. 14.—Map showing arid, semi-arid and humid regions of the United States. (After Newell.) (From Modern Geography by Salisbury, Barrows, and Tower.)

more attention to agriculture than to manufacturing. Agriculture is carried on almost everywhere. A nation may not have manufactures, but nearly every nation has agriculture, which

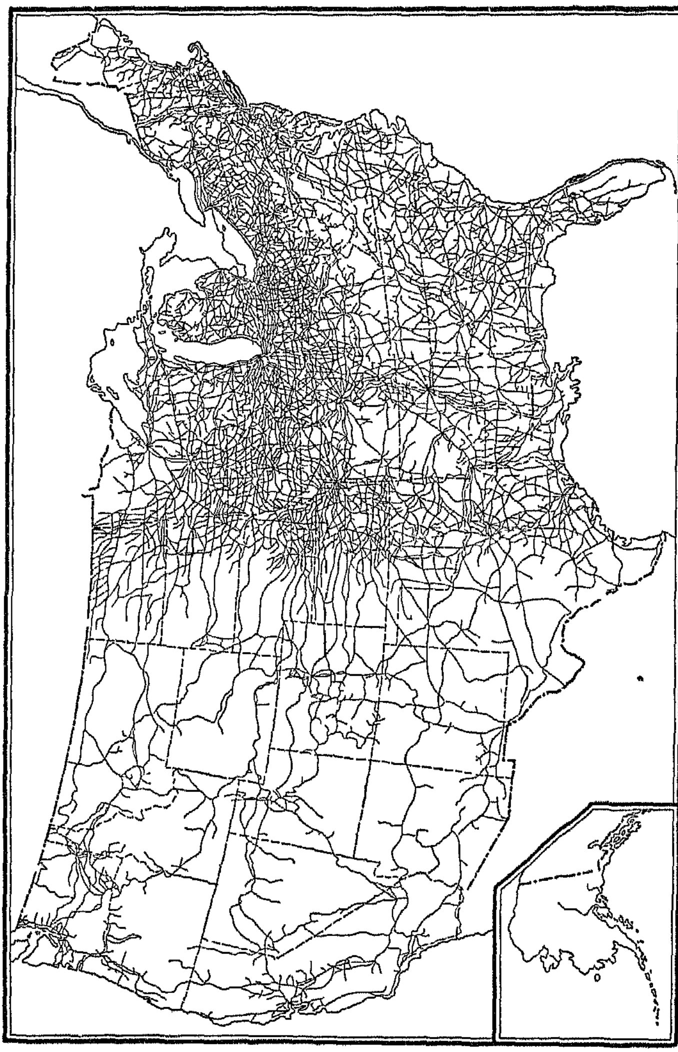


FIG 15 —The railroads of the United States in 1924 Note the relation between rainfall and railroads, which are a close index of human activity As an example of the influence of one climatic factor, compare the population of the states marked arid, with that of some large Eastern city or state.

furnishes raw materials for the local or foreign factory, and food for man and beast

Manufacturing is comparatively simple in that it goes on in buildings under man-made conditions Agriculture is carried on in the open, exposed to all the whims of wind, rain, sun, and frost as they are modified by altitude exposure and other factors There are many animals and many plants and many kinds of soil, so that agriculture is very complex, very scientific. In explaining it there is much that must be told In agriculture, the soil is of great importance, for it furnishes fertility, but climate furnishes the heat, light, and moisture, which are also essential to plant growth Climate thus becomes one of the great keys enabling us to understand countries (Figs 14 and 15) Other important factors in commerce and industry are minerals, topography (surface), and accessibility. Furthermore it is often necessary to go beyond these natural factors and to know the history and government of the inhabitants

The United States a world in itself. In this study of man making a living, we will first study the United States, taking up one after the other the great industries by which our people are supported. The United States is almost a world in itself. It has a great abundance and variety of natural resources, and a very favorable climate. These things have made it the richest nation in the world and have enabled it to have varied industries. Its lands range from the sub-tropic orange groves of Florida and California to the cold temperate shores of lakes Superior and Champlain. Its rainfall varies from the deserts of the Great Basin to the heavy soakings of West Washington and Louisiana. Its fields and forests are vast and its rich mines yield all the important minerals except tin and potash, and we have recently found a new way to secure potash from the sea.

Owing to the great importance of bread and breadstuffs, we should begin our study of commercial goods with the cereals.

PART I

THE UNITED STATES

CHAPTER I

THE CEREALS

Importance of cereals. Some cereal food is used by practically all peoples who can get it, for it is nearly a complete ration[1] The grain-producing plants such as wheat, corn, and rice, store starch, gluten, oils, and other elements of nutrition in their seeds, thereby providing for the nourishment of the young plant while it gets its roots well into the earth This food is furnished to the men of many lands by a much larger number of plants than we, as a wheat-eating nation, commonly realize.

The peoples of China, India, and Africa make great use of members of the sorghum and millet families, plants that grow quickly and resist summer drought well. The people of the United States having come from climates that suit wheat, corn, oats, rye, barley, rice, and buckwheat, have continued to grow these crops in this country even in localities better suited to some other crop. Finally we shall find out what each locality will produce best. This process of fitting our crops to our land will be somewhat interfered with by the fact that we esteem and will pay more for some grains than for others. Here, as in most other lands, wheat is the cereal most desired for bread, because the gluten it contains enables the dough to hold bubbles of gas created by yeast fermentation Hence wheat bread is lighter than that of corn, rye or barley.

[1] Proteid, the tissue or muscle-maker, is contained to some extent in all the grains from wheat, the richest in proteid, to rice the poorest Starch, the great carbohydrate food or energy maker, is also present in all of them, so that the grains, by containing both the great food elements, are almost perfect food Add leaf greens and fat and we could probably live for generations on any of them as has been done in Sicily with corn and olive oil

I WHEAT

The plant and its climatic requirements. Like all other cereals, wheat is a grass, and in the first part of its growth the plant consists of a tuft of green blades. Later it sends up stalks of straw that support the grain-bearing heads. The number of stalks and heads depends on the size and vigor of the plant, and these are greatly dependent upon the duration of cool, moist weather. If this cool, moist season of formative growth is long, the grass-like development is good and the heads many. A shorter damp period shortens the grain yield. The formative period is therefore important. In milder climates like the central United States south of Dakota, this period of formative growth includes the winter, hence the term "winter wheat" for wheat sown in autumn and harvested at the beginning of summer (see Fig. 16). Where the winters are too severe, as in North Dakota and West Canada, the formative period falls wholly in the spring and summer, hence the name "spring wheat," for wheat sown in spring and harvested at the end of summer.

After the moist weather of the formative period, there should be warm, bright, dry weather to ripen and harden the grain. Abundance of summer rain is fatal to extensive wheat growth, for fungus diseases attack the plant, and the grain often moulds or decays.

This double requirement of a cool, moist, formative period and a warm, sunny, ripening period, explains the importance of wheat in regions of rainy winter and dry summer, like the Mediterranean countries and our Pacific slope. These facts explain also its absence from lands of heavy summer rainfall, like the coasts of the Gulf of Mexico (see Fig. 17). On the rainy Gulf slope so favorable for cotton, wheat becomes less and less possible as one goes south, and the little that is grown in the northern margins of the east Gulf States and in Carolina has the lowest yield per acre found anywhere among English-speaking peoples. Large amounts of wheat are grown in the regions producing corn, but the same region cannot be equally well adapted for both wheat and corn, because the latter, like cotton, requires a considerable summer rain. This is fatal to best wheat growing.

Parts of the corn belt of the United States have, in addition,

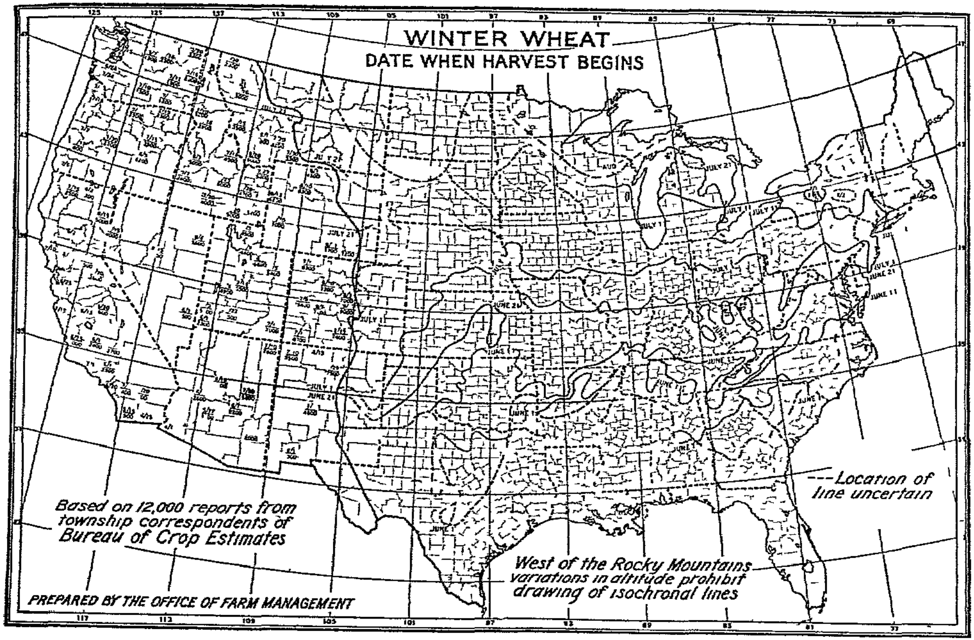


FIG 16—The harvest of winter wheat begins in central Texas usually about May 25, but is of little importance until Oklahoma is reached about June 5 It reaches its maximum size in central Kansas, where the harvest begins usually about June 15 By June 25, in the normal year, there are 50,000 transient laborers working in the wheat fields of Kansas Part of them have been gathered from the cities in the East, and in part the army is composed of local labor assembled from adjacent towns and villages By July 1 harvest has begun in south-central Nebraska, and the harvest army reaches the Dakotas and Minnesota between July 11 and 21 (United States Dept Agr)

another difficulty for wheat growing in the alternate freezing and thawing of the late winter and early spring. This is much worse than solid and continuous freezing. The expansion and resultant lifting of the top soil by freezing, and the contraction of the

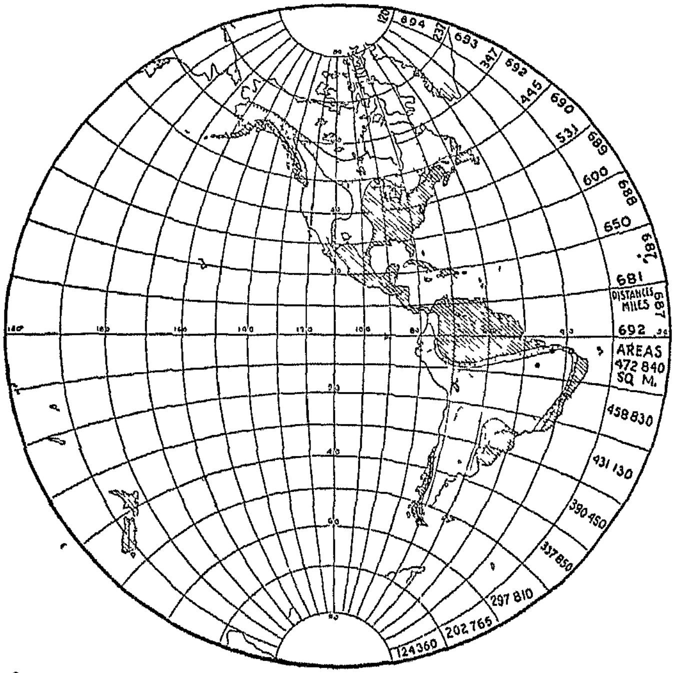
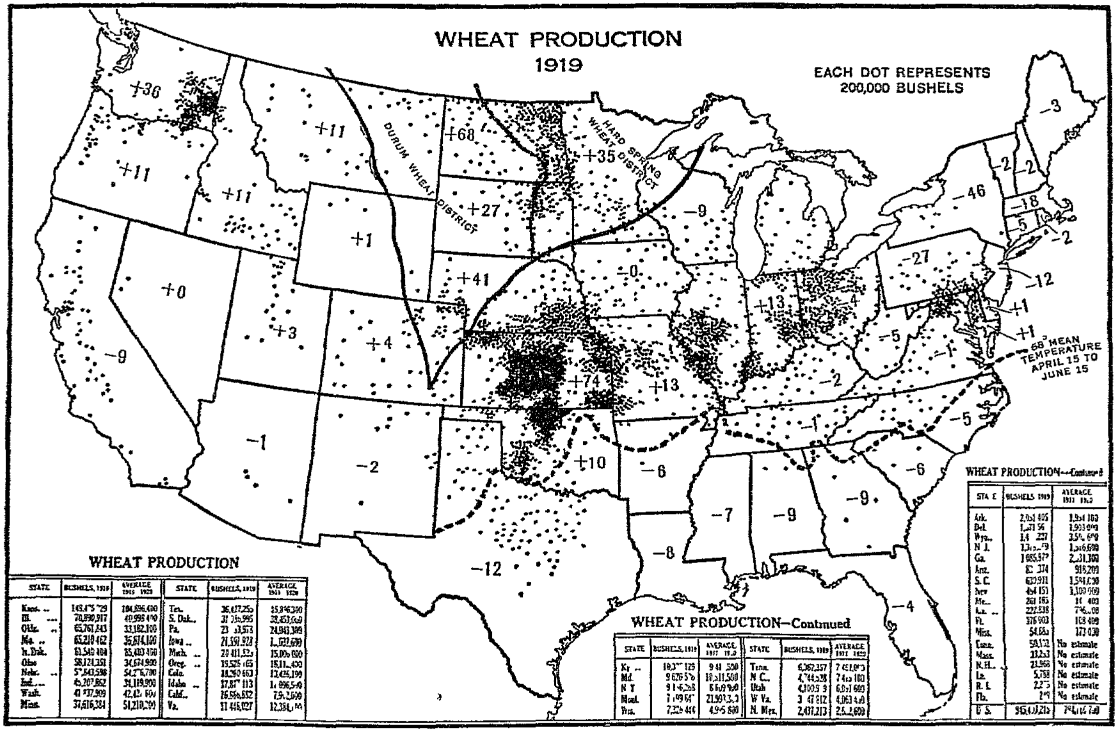


FIG 17 —Rainfall, June, July, and August. (After Mark Jefferson)

- Heavy—more than 10 inches of rain and melted snow in the three months
- Light—from 6 to 10 inches in the three months
- Scant—less than 6 inches in the three months

All the great wheat regions are in or along the margins of the regions of scant summer rain.

thaw, gradually pull the wheat plant out of the ground. As a result, wheat is much less important in many corn-belt localities, especially Illinois and southern Iowa, than it was 35 or 40 years ago, because the people finally learned that this land is better adapted to growing corn and oats. The wheat regions have been



WHEAT PRODUCTION

STATE	BUSHELS, 1919	AVERAGE 1915 1920	STATE	BUSHELS, 1919	AVERAGE 1911 1920
Kans.	148,475,729	104,896,400	Tex.	36,427,250	15,846,300
Ill.	70,890,917	40,995,400	S. Dak.	31 756,995	33,453,600
Okla.	65,761,243	33,182,100	Pa.	23 [illegible]3,573	24,943,300
Mo.	65,218,462	35,874,100	Iowa	21,591,928	1[illegible],022,600
N. Dak.	61,540,484	85,403,450	Mich.	20,411,525	15,006,000
Ohio	58,124,351	34,674,900	Oreg.	19,525,165	15,11[illegible],400
Nebr.	57,543,596	54,276,700	Colo.	18,260,663	13,425,199
Ind.	45,207,852	34,119,900	Idaho	17,877,113	1[illegible],896,540
Wash.	41,837,909	42,42[illegible]	Calif.	16,556,852	7,9[illegible],2600
Minn.	37,616,384	51,210,200	Va.	11,446,027	12,354,[illegible]

WHEAT PRODUCTION—Continued

STATE	BUSHELS, 1919	AVERAGE 1911 1920	STATE	BUSHELS, 1919	AVERAGE 1911 1920
Ky.	10,3[illegible] 125	9 41[illegible] 500	Tenn.	6,062,357	7 4[illegible]1,8[illegible]0
Md.	9 626 5[illegible]6	10,511,500	N. C.	4,744,528	7 4[illegible] 100
N. Y.	9 1[illegible]6,263	8 6[illegible]9 [illegible]0	Utah	4,103,9[illegible]3	6,8[illegible]1 600
Mont.	7 [illegible]9 54[illegible]	21,993,3[illegible]0	W. Va.	3 [illegible]47 812	4,063 4[illegible]0
Wis.	7,32[illegible] 446	4,9[illegible]5 800	N. Mex.	2,401,213	2[illegible],[illegible]600

WHEAT PRODUCTION—Continued

STATE	BUSHELS 1919	AVERAGE 1911 1920
Ark.	2,051 405	1,9[illegible]4 100
Del.	1,[illegible]71 56[illegible]	1,933 9[illegible]0
Wyo.	1,4[illegible] 227	3,5[illegible] 6[illegible]0
N. J.	1,3[illegible]	1,516,600
Ga.	1 055,577	2,[illegible]31,300
Ariz.	[illegible] 374	918,200
S. C.	630,911	1,591,030
Nev.	454 151	1,300 000
Me.	268 165	1[illegible] 400
La.	222,538	796,[illegible]00
Vt.	176 903	163 400
Miss.	54,685	173 030
Conn.	50,132	No estimate
Mass.	13,253	No estimate
N. H.	21,966	No estimate
La.	5,758	No estimate
R. I.	2,2[illegible]5	No estimate
Fla.	2[illegible]9	No estimate
U. S.	945,403,215	[illegible]

FIG 18.—The plus and minus figures on this map show the amount of wheat which the state had to import per year on the average before the Great War It is surprising how many of our states are like England in being dependent on imported breadstuff

Compare with the cotton map and we see how cotton's climate is wheat's enemy. (Adapted from the United States Dept Agr.)

shifted southwestward into Kansas, Oklahoma, and Texas, into a less frosty climate for winter wheat, and also northward into the colder Red River Valley of the North and to the plains of Canada, where the rigors of the winter climate have no direct effect upon the wheat because it is spring-sown (Figs 17 and 18).

In this region there is a very neat adjustment of crop to climate The rather scanty rain has its maximum in early summer, so here, as in California with its wet winter, wheat is sown at the beginning of the rains and harvested at the end of the rains

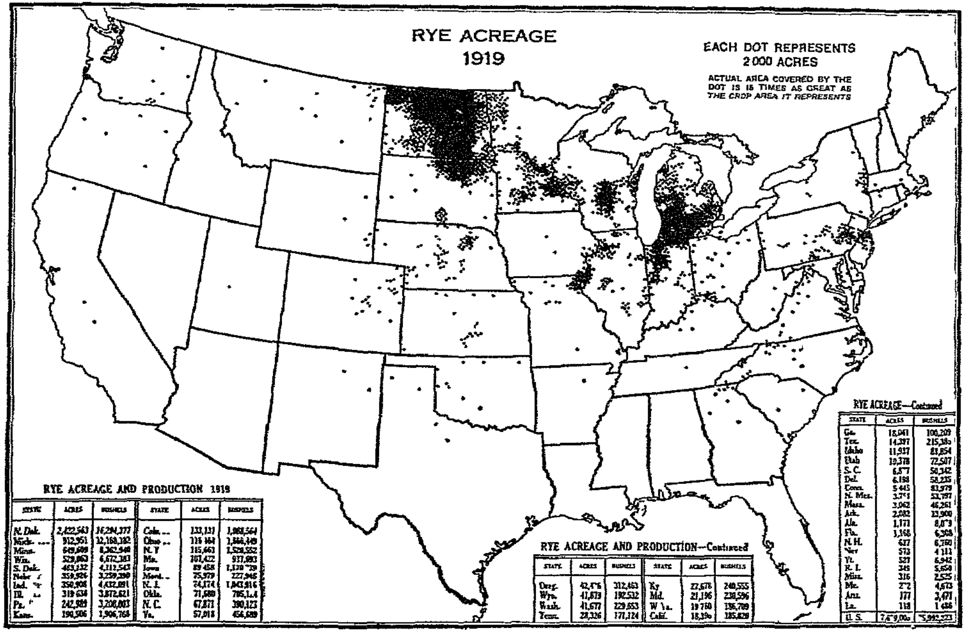
Wheat thrives with much less moisture than corn It is a crop that approaches the desert's edge It is important on the eastern, western, and northern margins of our arid belt, which centers in Arizona between the Rocky Mountains and the Sierras To the west of the Great Basin, across the Sierras in California, is the great valley of that state, for many years after 1860 one of the important wheat regions of the country. Its essentially Mediterranean conditions of winter rain and summer drought give it the best wheat climate in America, provided there is rain enough which is often not the case

It is unfortunate that there is not more land in California with an arable surface and a wheat rainfall. As it is, orchards, alfalfa, and the drought-resisting barley have caused a sharp decline in the California wheat crop

A second wheat belt is found as we go north and northwest from the deserts of the Great Basin, into an area of increased rainfall. This rainfall makes possible the wheat areas of eastern Oregon and Washington (Fig. 18). Here some wheat is grown in localities with less than 12 inches of rainfall per year.

The most important wheat belt in America closely follows the mid-continent line of 20 inches of rainfall and reaches from Texas north through Oklahoma, Kansas, Nebraska, the Dakotas, and Minnesota into Canada, where it expands into a vast area of great promise for the future (Fig. 17).

For several reasons, we do not yet know definitely how large this wheat area is. We do not know where its final northern edge will be because it is a temperature line set by the number of days between spring frost and autumn frost. If we have a quick growing variety of wheat, it can grow farther north where the season is shorter.



RYE ACREAGE AND PRODUCTION 1919

STATE	ACRES	BUSHELS	STATE	ACRES	BUSHELS
N. Dak.	2,422,543	16,294,377	Colo.	133,131	1,088,564
Mich.	912,951	12,168,182	Ohio	116,464	1,866,449
Minn.	649,609	8,362,940	N. Y.	115,661	1,528,552
Wis.	529,063	6,672,383	Mo.	101,472	937,093
S. Dak.	463,132	4,112,543	Iowa	89,458	1,120,739
Nebr.	359,926	3,259,390	Mont.	75,979	227,945
Ind.	350,908	4,432,091	N. J.	74,174	1,043,916
Ill.	319,634	3,872,621	Okla.	71,680	705,1.4
Pa.	242,988	3,208,003	N. C.	67,871	390,123
Kans.	190,506	1,906,768	Va.	57,018	456,689

RYE ACREAGE AND PRODUCTION—Continued

STATE	ACRES	BUSHELS	STATE	ACRES	BUSHELS
Oreg.	42,476	312,463	Ky.	27,678	240,555
Wyo.	41,673	192,532	Md.	21,196	238,596
Wash.	41,677	229,553	W. Va.	19,760	196,709
Tenn.	28,326	171,124	Calif.	18,390	185,828

RYE ACREAGE—Continued

STATE	ACRES	BUSHELS
Ga.	18,041	100,209
Tex.	14,397	215,385
Idaho	11,937	83,854
Utah	19,378	72,507
S. C.	6,577	50,342
Del.	6,198	58,235
Conn.	5,445	83,979
N. Mex.	3,751	53,797
Mass.	3,062	46,261
Ark.	2,082	13,900
Ala.	1,171	8,073
Fla.	1,168	6,308
N. H.	627	6,760
Nev.	573	4,111
Vt.	527	6,942
R. I.	345	5,650
Miss.	316	2,525
Me.	272	4,673
Ariz.	177	3,471
La.	118	1,486
U. S.	7,679,006	75,992,523

FIG 19.—Europe is ahead of America in rye growing partly because she has such a large area of cold, sandy plain to the north of her wheat belt. When America has as many people as Europe, our rye area will be much larger than it is now. We will be growing rye on many sandy stretches and now unused, or little used, upland fields between Carolina and the plateaus north of the St Lawrence, between Canada and Nova Scotia (United States Dept Agr)

In similar fashion, the western and southwestern limit of this central North American wheat field is again a climatic line, the line of light rain

Both of these climatic lines are strangely unfixed It seems like a jest, but the location of these climate lines depends in part upon mechanical invention

A little figuring makes this plain Anything that makes cultivation easier, so that one man may cultivate more acres of ground, makes it possible to use with profit land which before could not be cultivated If the wheat growers of Canada and the United States had to depend upon the wooden plows used by our colonial ancestors in Massachusetts and Pennsylvania, and cut the crop with sickles, small indeed would be the wheat region of Canada or of Dakota. This brings us to the whole question of the relation of machinery to wheat, in which we have had astonishing changes in the past, and the end is not yet, for the farm tractor, which seems to be in its infancy, is perhaps the most revolutionary single farm machine ever invented.

Effect of machinery on wheat production. The production of wheat has been made much cheaper and easier by mechanical inventions. Eighteenth century wheat was cut in the Scriptural way by sickle. The laborer with one hand grasped a few stalks of the grain and cut them off with a sweep of the sickle held in the other hand (Fig. 20). The next implement in general use was the cradle, invented in New England in 1806. It was a kind of scythe provided with fingers to catch and throw into an even row the straw it cut. In 1851 Cyrus McCormick, of Virginia, made a reaper which cut and dropped the grain in bundles to be bound by hand Then came the self-binders, or reapers that also tie the bundles, and finally the binders that carry the bundles and drop them in piles where the shocks are to be made (Fig 21) A driver with three horses operating one of these machines has no difficulty in performing as much work as was done 60 years ago by from five to seven men working arduously with cradles, rakes, and blistering hands. The work is occasionally done by women, as the physical effort has been reduced until one now merely drives horses and regulates the cutting by adjusting easily operated levers on the reaper

Similar improvements have been made in threshing, which is

equally a part of wheat production. It is not so very long since men in this country helped thresh by the Scriptural method of driving horses around and around upon the sheaves that their feet might shatter out the grains upon the threshing floor. A method similar to this, in which the horses drag a rolling stone around the threshing floor is still in use in Russia, Turkey, and other countries adjacent to the Black and Mediterranean Seas In more progressive regions, under the influence of high wages,

FIG 20—Arabs in Tunis harvesting wheat by primitive methods preparatory to threshing it under the feet of camels The Bedouin is little influenced by our machine industry

the steam thresher (Fig. 22) does nearly all the work In the United States, it is common for one of these machines to thresh a thousand bushels of wheat per day and be taken at evening to the next farm by its own traction engine. These revolutionary improvements in wheat production cheapened its labor cost in favored localities from 133 minutes of human labor per bushel in 1830 to 10 minutes in 1904

Similar improvements have been made in machinery to prepare the soil and plant the seed

The machinery for planting, harvesting, and threshing wheat has also been adapted, with minor changes, to do the same work for the other small grains—rye, oats, barley, and buckwheat, and even rice. The cheapening that results from the easier production permits wheat to become more universally used as food. It is now eaten by many people in the southern United States who

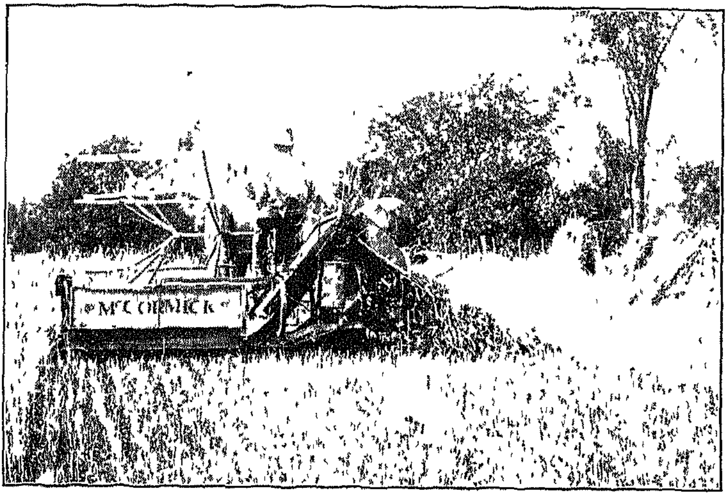


FIG. 21.—Harvesting by machinery in the United States. The machine cuts, binds, and carries the sheaves of small grain. (International Harvester Co.)

previously made a larger use of corn. Before the World War the same thing was done in Germany and Austria, by people who had been living on rye bread; and even the Chinese and Japanese are increasing their use of it as a luxury to replace partially their cheaper foods of barley, rye, millet, and the more expensive rice.

Where wheat is grown on hundreds of acres, still more specialized machines are used, the most complicated of which is the combined harvester and thresher. This machine can be used best when very dry summers, such as occur in the Columbia River basin and the great valley of California, permit the grain to dry out on the stalk so that shocking it up to cure it is not necessary. Here the combined harvester and thresher, driven by

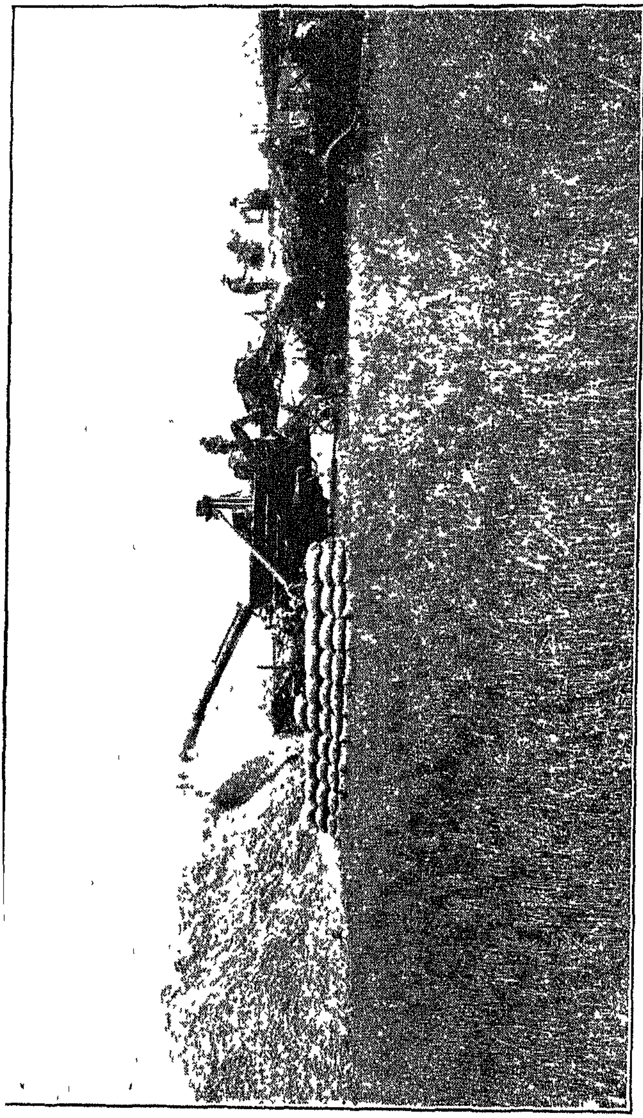


FIG 22.—American threshing outfit at work in the Pacific Northwest.

engine or drawn by twenty-five or thirty horses, sweeps over the great fields and daily puts into sacks the thoroughly dry grain of thirty acres of waving wheat fields.

These machines were invented shortly after the railroad had given us commercial access to extensive level, treeless, fertile plains and prairies in the center of the continent, and settlement and wheat growing went forward with great speed The population in this granary of our country is not large because one man can cultivate so great an acreage that a single family can easily take care of several hundred acres. It is populated by machines

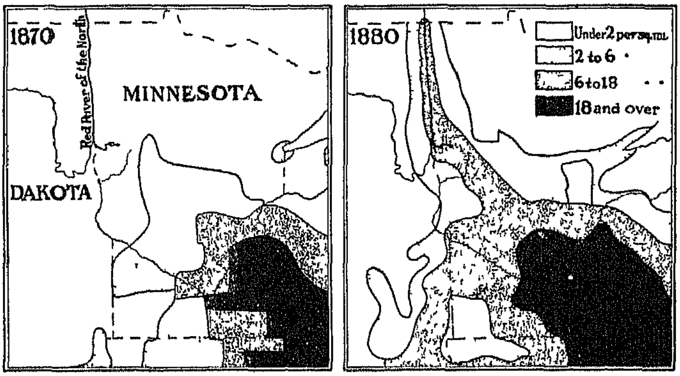


FIG 23.—(a) Map showing distribution of population in region of Red River of the North in 1870 (b) Population map of region of Red River of the North in 1880 The level, treeless, fertile plain of the Red River Valley was settled almost entirely by wheat growers, and the population of Dakota increased from 14,-000 to 135,000 between 1870 and 1880

rather than by men, and the machines are still increasing the area one man can tend

Another mechanical invention has increased wheat growing and influenced the speed of settlement in the region north of Minneapolis (Fig 23) The wheat that grows there is so hard and brittle that the husk broke up when ground by the old-fashioned mill stones, and the flour was dark and not desired. The gradual reduction by repeated pressing between steel rollers makes fine white flour and suddenly gave spring wheat flour the leadership of the market, although it is less wholesome than the browner flour it displaced.

The one-crop system of the agricultural frontier. Wheat, which is valuable, salable, and easily transported, is often the best money crop that can be produced in newly settled regions, hence it is grown year after year for 10 to 20 years after settlement. This brings in weeds and gradually exhausts the soil, until the declining yield makes it necessary to rotate the crops, to grow clover and to keep animals in order to build up the soil again. This is the cycle of the agricultural frontier. It has been witnessed in Illinois, Iowa, Minnesota, Dakota, and is now going on in Washington, Canada, Argentina, Siberia, and other regions, where the early farmers wasted their soil resources by the one-crop system

The Red River Valley of the North, comprising the major part of the wheat districts of Minnesota, North Dakota, and Manitoba, like the black-earth districts of southern Russia, is now experiencing a decline in yield and its continuous wheat production is giving way to mixed farming With the possible exception of the Russian black-earth belt, there never was in the whole world an easier place than the Red River country for the growth of wheat This fertile plain, the bed of a glacial lake, often for miles literally as flat as a floor, without a stone or tree, lends itself perfectly to the use of the most complicated machinery and large-scale production Year after year wheat has been grown until the declining yield has made the farmers turn to other crops—the raising of horses, the keeping of cattle, the making of butter The total yield from these districts has not declined greatly because of the steadily increased percentage of the land that goes into wheat in the one-crop period and the improved yields that follow the introduction of crop rotation and live stock

At the present time in western Canada, where new railroads cross open, almost empty, treeless plains, the new settlers are again beginning with continuous wheat growing which will be kept up one, two, or three decades before they too must take to other crops and to keeping cattle. In the meantime these wheat crops on the virgin prairie soil of the harvest frontier are larger than those of the Red River Valley It is possible that the Canadian region suitable for the extension of wheat growing reaches 60° north, near the base of the Rockies. Even Alaska reports good crops of wheat on the Tanana river. If experience

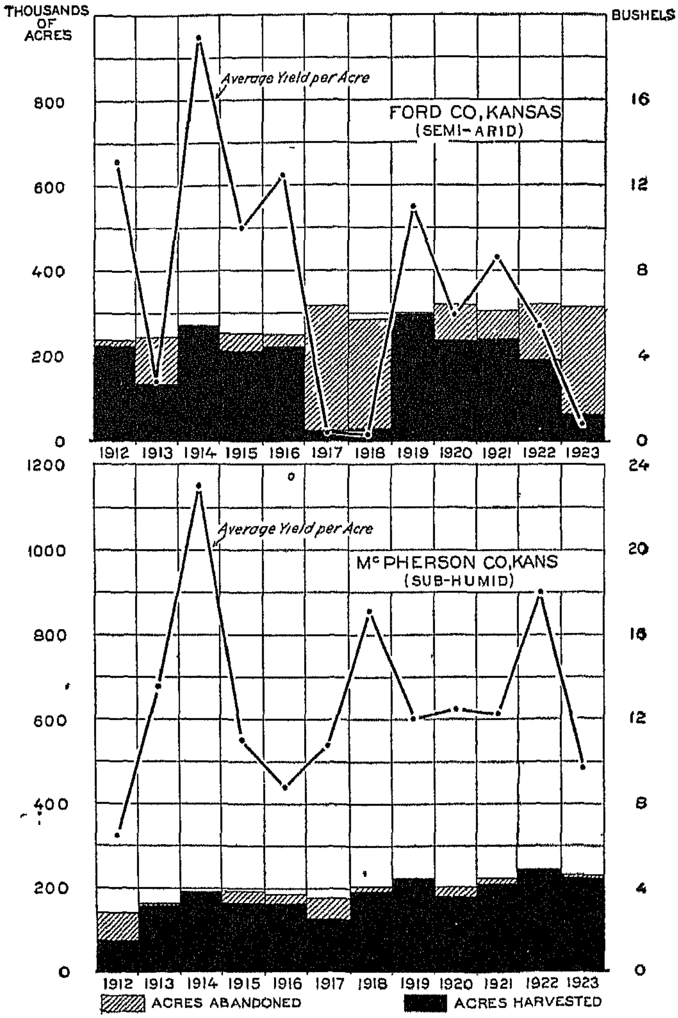


FIG 24 —The semi-arid West produces much wheat but at a greater risk During the 12 year period 1912–23 the acreage abandoned in semi-arid Ford County was 37.1 per cent of the planting, while in sub-humid McPherson County it was only 9.4 per cent. (United States Dept. Agr)

proves these northern regions dependable, their wheat-growing possibilities are enormous, and the continuous cropping method will have land to support it for several decades.

The Italian farmers, who have sometimes gone to Argentina at the rate of 100,000 per year, have had almost an identical experience upon the magnificent black-soil plains that lie along the western banks of the Parana River The Russian peasant also exploits in the same way when he emigrates to central Siberia and settles on those endless plains called steppes where now the trans-Siberian railroad has made possible the export of

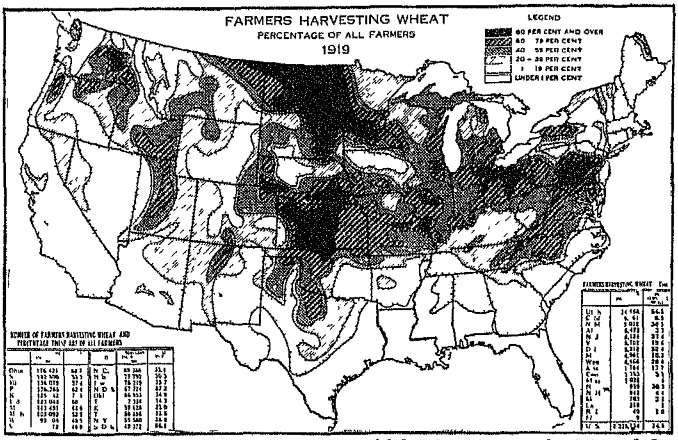


FIG 25 —No other one crop is grown as widely throughout the United States as is wheat (United States Dept Agr)

grain After a time these Siberians also must rotate crops, keep cattle, and export butter and eggs to London, as their brethren in the older and more developed lands of Russia and West Siberia have done both before and since the World War

Despite the leadership of the central wheat districts of the United States, their yield is less per acre than that of the North Atlantic States, and far less than it is in northwest Europe. But on these cheap, carelessly tilled lands of the frontier, the yield *per man* is much greater (Fig. 25) than on the more laboriously tilled fields of Europe. The distribution of the world's wheat crop is a fine illustration of the fact that products are often

grown in places that are not best suited to them This does not prevent the crop from being the best thing to grow in that particular place. Thus, western Kansas is not the best place in the world to grow wheat, but owing to a combination of many

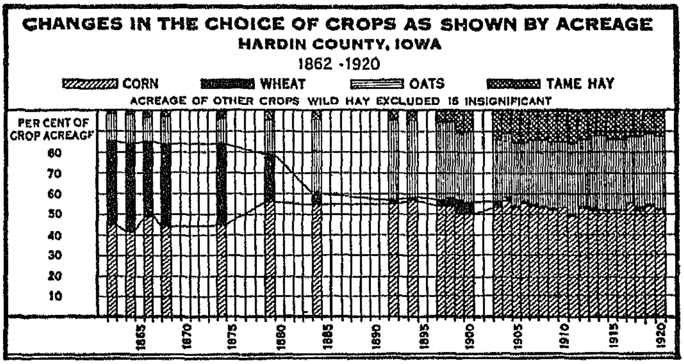


FIG. 26—Wheat is a frontier crop It tends to diminish in importance as a region becomes thickly settled (United States Dept Agr)

reasons wheat is the most profitable crop that can be grown there (See table of crop comparisons in Appendix)

Situation of wheat-exporting regions compared. The wheat exporters of southern Europe, on the Black Sea, share with the exporters of Argentina and Australia the advantage of cheap ocean transportation. The wheat exporters of the United States and Canada grow their surplus for export in the heart of a continent a thousand miles or more from seaports. That this last region nevertheless takes its place among export regions is due solely to the excellence of the transportation conditions which have made possible the bringing of wheat to ocean harbors where it could be exported. In 1825 the Erie Canal connected the Hudson River with the Great Lakes and made possible boat transportation from the shores of the Great Lakes to New York at a fraction of the previous cost. This made possible the extensive growing of wheat in western New York, northern Ohio, Michigan, and other lake shore districts Ohio ranked first among the wheat-growing states in 1839. Twenty-five years after the canal opened the lake shores to the world market, railroads began to reach out from these inland waterways across the plains and

from that time to this wheat has gone eastward to the sea in millions of bushels, being gathered together in the great markets, first at Chicago, and later at St. Louis, Kansas City, Milwaukee, Duluth, Port Arthur, and Winnipeg. A new railroad is being built from the Canadian wheat country to Hudson Bay, where for a short time after wheat harvest, steamers can carry out Canadian wheat before the ice closes for the season this great and at present almost unused arm of the sea. For many years the movement of wheat east of the Rocky Mountains was almost exclusively to the Atlantic and Gulf ports, most of it passing

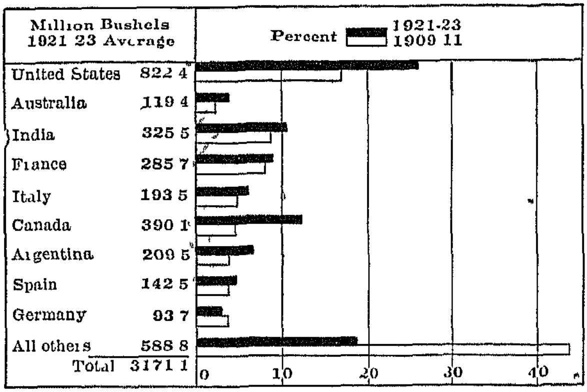


FIG 27 —World wheat production, three-year average.

down the basin of the Great Lakes, whence, as a result of railroad agreements, it scattered to reach the sea at all ports between Montreal and Norfolk. From Kansas and southward, the Gulf is nearer than the Atlantic and much wheat reaches the ocean steamer at New Orleans and Galveston Between 1920 and 1923 there was a rapid increase in the shipment of Alberta wheat via Vancouver, even when bound for Europe

The wheat of the Columbia River basin is exported from Portland and the Puget Sound ports Some of the Pacific Coast export goes to the Orient but most of it still goes to Europe by cheap water transportation, which has always been less expensive than an overland journey to an eastern port.

The Siberian wheat plains, drained to the frozen Arctic and

shut off by mountains from the southern sea, have the worst situation of all wheat exporters with regard to the sea. The Siberian crop must make the long rail journey to the Baltic or White Seas unaided by any such gift of nature as the American Great Lakes or the Danube River. For this reason the Siberian plain was the last of the world's great plains to be settled. The railroad enabled it to become a wheat exporter before the war, but its average pre-war crop combined with that of the adjacent Russian provinces of Central Asia amounted to but 84 million bushels (1909–13), which is less than the present average production of North Dakota. But Siberia has the resources of great area and fertile soil which can be utilized for a great export, after Russia has recovered from her present bankruptcy and famine.

Manufacture and commerce in wheat. Minneapolis is the greatest flour-milling city in America. It is situated at the

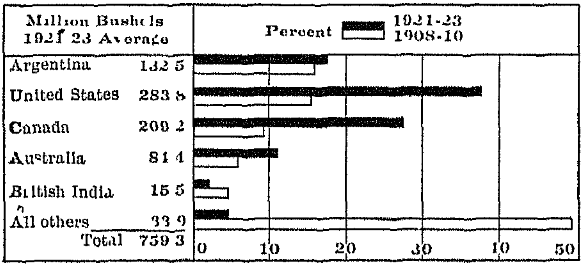


FIG. 28.—Wheat and wheat flour exports, three-year average.

gateway to the spring wheat plains that reach more than a thousand miles to the northwest. Power for its mills is furnished by the nearby Falls of St. Anthony on the Mississippi. Other flour-manufacturing centers are Buffalo (now disputing the flour-milling supremacy of Minneapolis), Niagara Falls, and Rochester, three cities of New York state having water power and also located on the grain route to the East. Wichita, Kansas, now claims rivalry with Buffalo. Breakfast foods are also made entirely or in part from wheat, and are manufactured in most of the larger cities where rail or water routes make it easy to bring in the grain and where the dense population affords a

ready market for the finished product Bran, the outer covering of the grain, and middlings, the germ, which are important cattle foods, are produced at all the great milling centers

Wheat was an important export of New Amsterdam (New York) as early as 1656, and has been important ever since. In

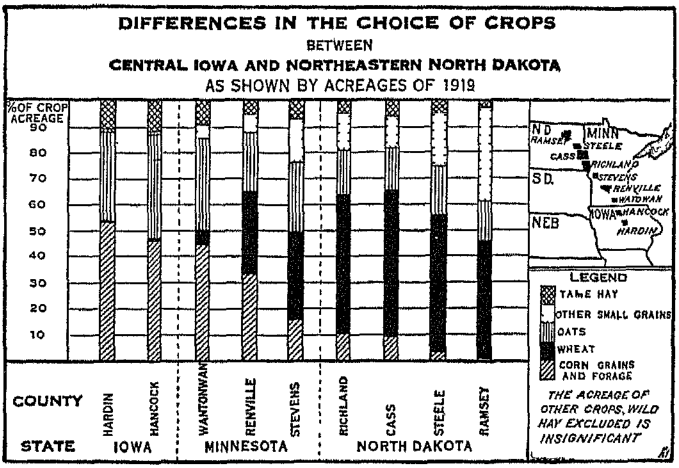


FIG. 29.—This chart of the leading crops between central Iowa and central North Dakota shows where the Corn Belt ends and the Wheat Belt begins Notice the importance of oats as a secondary crop in the Corn Belt (United States Dept. Agr)

colonial times it went chiefly to the West Indies where wheat does not grow During most of the nineteenth century the trade has been chiefly with Europe and wheat has been the leading agricultural export of the North The future, however, promises to see our export of wheat decline in importance and in quantity. It first declined in favor of flour exports. This was soon followed by a conspicuous decline in the export of both wheat and flour, because our increasing population leaves a smaller and smaller surplus for other lands. The phenomenal export during the war was but a temporary exception It showed what we *could* do and the slump showed what rivals could do California furnishes an interesting example of this change That state, once a great wheat exporter, reached her maximum wheat acreage in

1893 Since that time alfalfa fields and fruit orchards have cut in on the wheat area until it does not now supply even the needs of the state The California bean crop is more valuable than

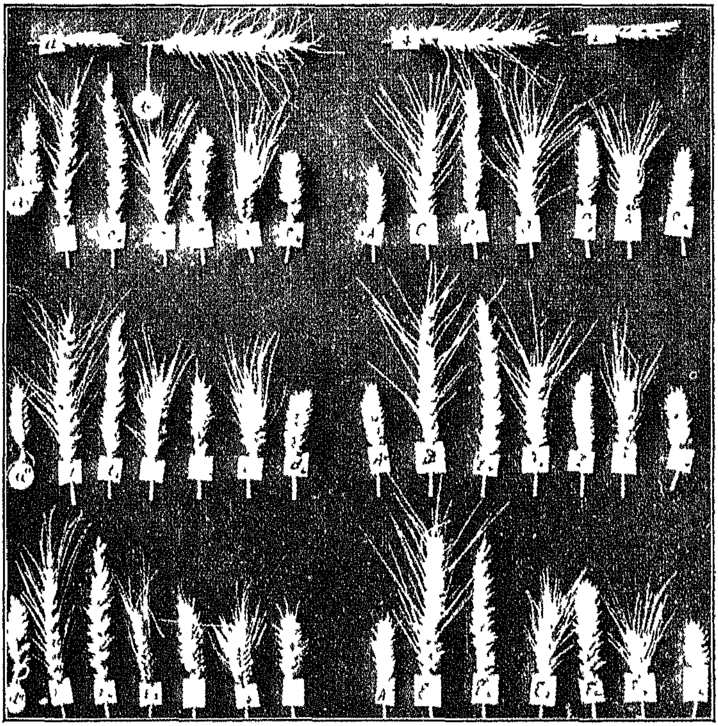


FIG 30—An experiment in plant breeding, cross-bred wheat showing great variation in offspring of hybrids.

ab = parents
a′a″a‴ = offspring of abCross

c_1c_2, d_1d_2, e_1e_2 etc = offspring of a′a″a‴

A B. = parents same variety as ab but crossed the other way
A′A″A‴ = hybrid offspring of AB-cross

C_1C_2, D^1D_2, E^1E_2 etc = offspring of hybrids A′ A″A‴

the wheat crop Canada, Argentina, and Siberia possess the new lands for the one-crop farmer to cultivate, rob for a time, and thus supply the world market.

Our future wheat supply. We can increase our wheat production greatly by the introduction of better varieties from other lands, by breeding better varieties of the grain, and by improved cultivation and fertilization of our fields The recent introduction to the United States and Canada, of a drought-resisting variety of wheat known as Durum, from the arid lands of eastern Europe, has resulted in the extension of the wheat area into the drier lands of our desert edge, which before were practically useless for agriculture This variety of wheat contains much gluten and is thus very valuable for the manufacture of macaroni. More than 4 million acres of this wheat are now grown annually in the United States

The introduction of new varieties gives new *materials* for the plant breeders to use (Fig 30) Plant explorers are now scouring all possible corners of the world in search of plants especially adapted to particular purposes and conditions Several varieties of Australian wheat introduced into the Pacific Coast states have increased the yields and proved superior for milling These plants, specialized in one or more qualities to the point of perfection, can be used as parent plants by the plant breeders They have recently developed from Kubanka Durum wheat an improved strain called Nodak, with greater rust resistance.

2. Rye

Next to wheat, the Caucasian peoples eat rye as a breadstuff. Botanically, rye is closely allied to wheat which it resembles, but the grain is smaller and darker, less nutritious, and hence less valuable That the world's pre-war production of rye was nearly one-half that of wheat is due to the fact that under certain conditions it will produce more food per acre than wheat It is hardier than wheat. The United States rye belt runs across the country 300 miles farther north than winter wheat. In the spring wheat region rye enlarges farm activity by providing a fall-sown crop which can be harvested before wheat is ready. Rye also grows more successfully on thin, sandy, or sour soils, and is less affected by rust and insect pests.

Rye was an important crop to the early settlers in the northeastern states, but after the settlement of the fertile level west,

it was neglected in favor of wheat. Rye-growing more than doubled between 1913 and 1923 and equals one-tenth of our wheat crop. It is now more important in the spring-wheat belt than in the poorer lands of the northeastern states Canada has also made a significant increase in rye production Northern Europe, where there is much sandy soil and a cool climate, is the rye center of the world Before the war Russia produced one-half of the world's rye and Germany one-fourth. These two countries grow far more rye than wheat and dark rye bread is the staple food of the people.

3. Oats

Among cereal crops in the United States oats stand third in importance. The oat plant is hardy and will grow in a colder climate than wheat, but it requires more rain Its moisture requirement bars it from the regions of Mediterranean climate, like California, with their hot dry summers. It is commonly spring sown in localities where the other small grains are fall sown, and the grain is chiefly used as forage, especially for horses. For these reasons it is grown to some extent in nearly all the important northern wheat regions and also in rye and northern barley regions. In the southern part of the winter wheat belt, winter sown oats are grown and have the advantage of ripening earlier in the season than wheat.

Oats grown on same farm as Indian corn. The fact that oats are better adapted to general farming crop rotation than any other small grain makes the crop a very important one in the corn belt of the United States. In much of this territory the moisture of summer and the alternate freezing and thawing of the open winter are alike unfavorable for wheat. Oats, standing more moisture and not being hurt by a little frost, can be sown very early in the spring before corn is planted Since it is not necessary to plow the seed bed (harrowing suffices) oats permits great economy of labor. The crop requires no attention until harvest time, which does not occur until after the corn has been both planted and cultivated. Then while the corn is maturing, after the hay harvest or possibly before it, the oats are harvested. The excellent way in which these crops dovetail together makes

the field of oats as well as the field of corn and the field of hay parts of the great corn belt farm system In this way is grown the greater part of the United States oat crop, a billion and a quarter bushels—equal to the total production of all Europe. Oats are not generally a cash crop, but are fed on the farm where grown.

4. Barley

Barley closely resembles wheat in appearance, is the hardiest of the important cereals, and has a much wider climatic range than wheat

The wheat limit in Russia is near Leningrad, but barley goes on to the Arctic It is pilfered alike by the sledge-drawing

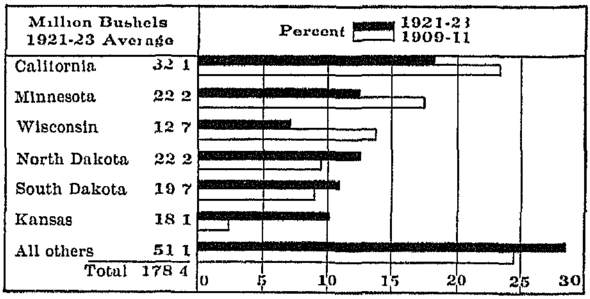


FIG 31 —United States barley production, three year average

reindeer and the desert-crossing camel. It is important in northern Norway and Sweden, and in the adjacent Lapland, growing beneath the midnight sun, and ripening 150 miles beyond the Arctic Circle It is regularly grown in Finland and north Russia to the shores of the Arctic Ocean, and its ability to resist droughts and heat causes it to be grown as far south as the Nile Valley, Abyssinia, and the east point of Africa near the equator.

The grain lacks gluten, and for that reason it will not make the sticky dough necessary to good light bread. But because barley yields nearly twice as much per acre as does wheat, it is a forage crop where corn cannot be grown, as on the Pacific slope of the United States, and beyond the corn belt in the plains from Texas to Dakota (Fig 31) It will thrive with less rain

than wheat and is consequently replacing wheat in California, which now produces a fourth of our barley crop Our greatest single barley district is north of the corn belt in the spring wheat region of the Dakotas, Minnesotas, and the states of Wisconsin and Iowa.

5 BUCKWHEAT

Buckwheat, an unimportant cereal, is among grains as the goat is among animals—conspicuous for its ability to nourish itself where the supply of nourishment is meager It grows so quickly that it can be sown in midsummer after other crops have failed, or have been harvested, and yet ripen before frost Its qualities combine to make it a crop for farms of rough and mountainous localities, such as the Appalachian Plateau in New York and Pennsylvania, and parts of New England and Canada. Its chief use is for making griddle cakes in regions where maple syrup is easy to obtain.

6. RICE

Rice characteristics and rice climate. Without rice the human race would be greatly handicapped for locally grown cereal food in the torrid zone and in some parts of the warm temperate zone where there is a heavy summer rain, as along the Gulf Coast in the United States. In such a climate all the European grains—wheat, barley, rye, oats, and buckwheat—fail miserably, and corn (maize) is not at its best, owing to the bad effects of the moisture which prevents the grains from hardening Commerce would find difficulty in filling the gap because it is so difficult to keep these northern grains from spoiling in a hot moist climate Trouble is often experienced in shipping corn down the Mississippi River and through the Gulf of Mexico to Europe, because the humidity causes the grain to heat and mould. It is indeed fortunate that countries with these climatic conditions can grow rice, Asia's great gift to the world, a grain which thrives under wet summer conditions and which, owing to the dryness of the kernels and to a protecting husk, can be kept without deterioration—a tremendous advantage. This grain is to the regions with wet summers what wheat is to the regions with dry summers. The two plants do not thrive in the same region unless, as is the case in a few districts of China and Japan, a crop of winter

wheat can be harvested before the beginning of summer rains which furnish the proper conditions for rice

Distribution of rice. Unfortunately, rice, like barley, has little gluten and will not make light bread, but its great keeping qualities make it a food prized in nearly all lands engaged in commerce. It has been grown in the Orient for ages and was early imported as food by the American colonists After the surprising success of the governor of South Carolina in raising a

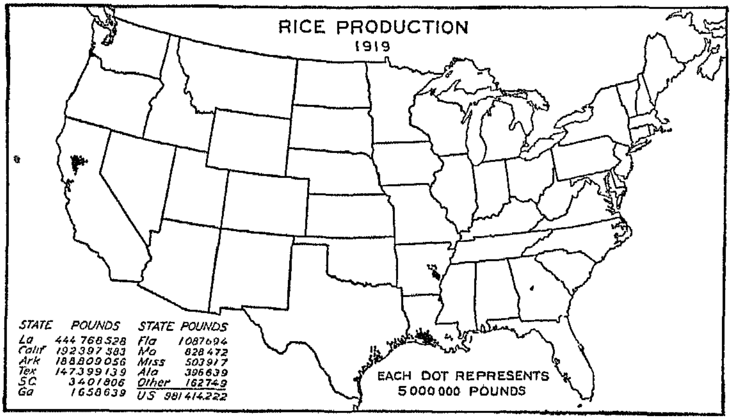


Fig 32 —America's capture of an old world crop is shown in her rice industry along gulf coast of Texas and Louisiana, in Arkansas, and in the Sacremento Valley of California (United States Dept Agr)

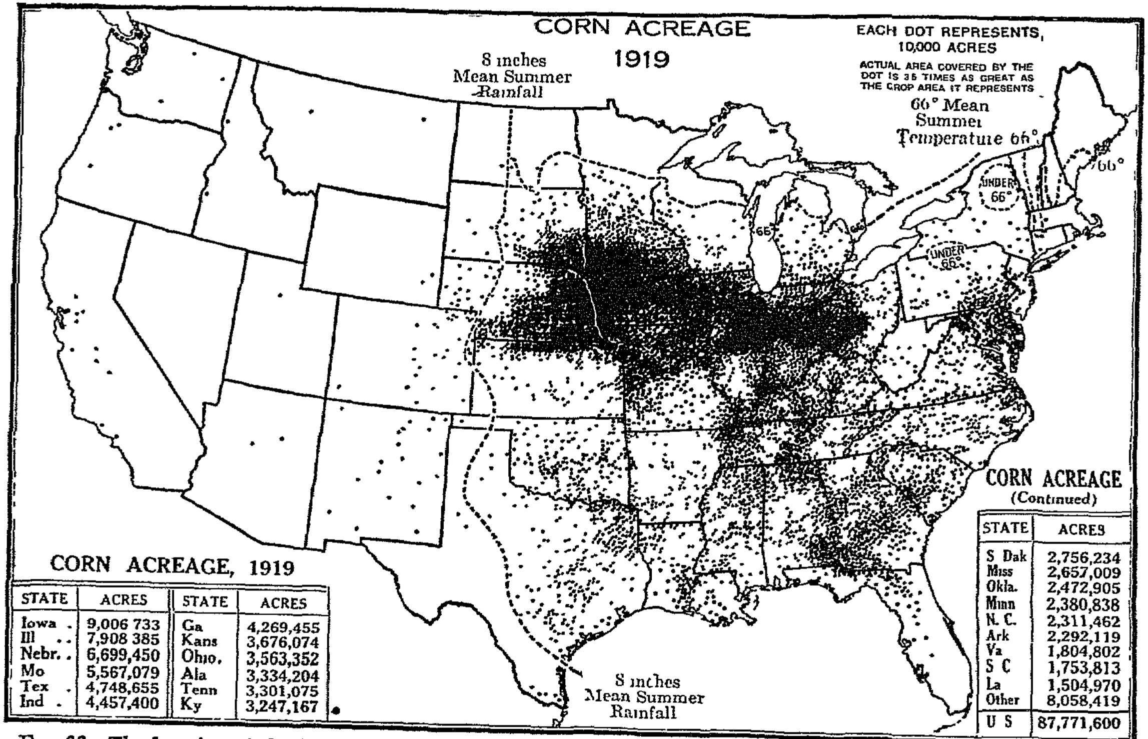
patch of rice in his garden in 1694, rice growing became an important industry in that colony and in Georgia. Swamps along the seacoast and rivers could readily be dyked off, irrigated, and cultivated in the Oriental way by negro slaves. These two states have grown rice of excellent quality down to the present day, but they are now suffering from the competition of the newest and most interesting of all the world's rice fields, that upon plains near the Gulf Coast not far from the boundary between Louisiana and Texas. In this level, well-watered, marshy and little-used district, the machinery and methods of wheat growing have been adapted to rice growing. The Sacramento Valley in California began commercial rice growing in 1912 and that state now has a production second only to Louisiana.

The conquest of this primeval Oriental hand-labor garden crop by American farm machinery has enabled one man to take care of 80 acres of rice in a year Although he is paid twenty times as much as the Chinese laborer, he produces rice more cheaply because the Chinaman cares for only 1 or 2 acres by his arduous hand labor In spite of our successful American production methods, however, the fact remains that we produce only about 1 per cent of the world's rice while India grows 60 per cent and Japan 20 It is still to be proved that white men can maintain health and vigor in the necessarily damp climate, with its abundant mosquitoes, which accompanies the irrigation of land upon the warm and moist shores of the Gulf of Mexico The attempts at "upland rice culture" have not as yet been a commercial success—so great is the dependence of this aquatic plant upon a saturated soil

Since large areas in China, Japan, India, Indo-China, and the East Indian islands have both the humid air and wet soil, rice is the chief crop and chief grain food of several hundred million people

7 Corn or Maize

Uses of corn. Corn is properly called the king of American forage plants. It differs from wheat in having a stalk an inch in diameter, and 6 to 15 feet high The ear is sometimes a foot long Corn is commonly planted in rows and the ground between them is cultivated to prevent the growth of weeds and to keep the soil loose and moist Its large size and the cultivation permit it to be grown on rough and recently cleared ground where small grains would not thrive. For these reasons it was of especial service to the early colonists It could be grown in small clearings in the forest too rough and too shady for other grains It yielded twice as much as wheat, was easily kept, and could be served as food in many forms—as parched corn, made by heating the whole grain in a frying pan or over an open fire; as hominy, which is the cracked corn thoroughly boiled, as mush or samp, made by boiling the meal, or, finally, as cornbread. The husk that protected the grain served in the mattress for the colonist's bed, the stalks and leaves fed the horses and cows through the winter, even after they had served for months as a



CORN ACREAGE, 1919

STATE	ACRES	STATE	ACRES
Iowa	9,006 733	Ga	4,269,455
Ill	7,908 385	Kans	3,676,074
Nebr.	6,699,450	Ohio.	3,563,352
Mo	5,567,079	Ala	3,334,204
Tex	4,748,655	Tenn	3,301,075
Ind	4,457,400	Ky	3,247,167

CORN ACREAGE (Continued)

STATE	ACRES
S Dak	2,756,234
Miss	2,657,009
Okla.	2,472,905
Minn	2,380,838
N. C.	2,311,462
Ark	2,292,119
Va	1,804,802
S C	1,753,813
La	1,504,970
Other	8,058,419
U S	87,771,600

FIG. 33—The location of the line of eight-inch mean summer rain in the west and of 66° mean summer temperature in the north shows how definitely the corn region is fenced in by climatic factors (United States Dept Agr.)

thatch for the temporary shed that shielded the animals from storm Because of its ability to grow on rough ground it is of great service to the people of such localities as the Appalachian district from Georgia to New York

This locality with its inferior corn crop furnishes a good example of the influence of environment on history About the

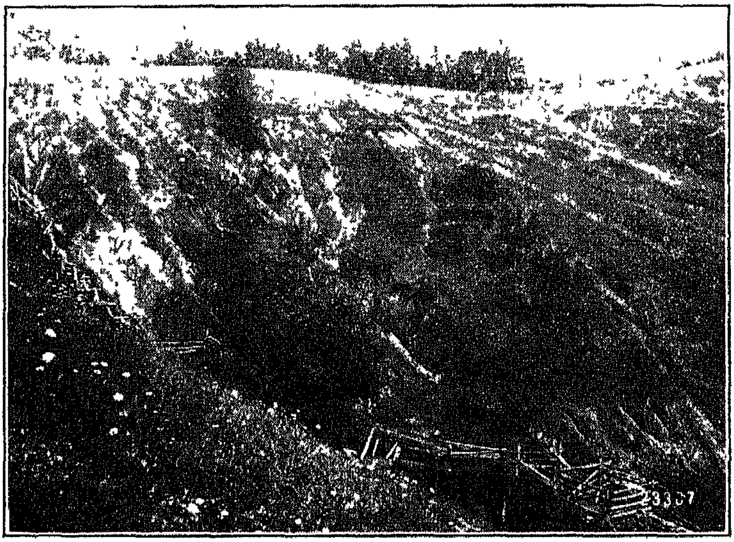


FIG 34—Gullied hillside in the Piedmont section of Virginia This field has been ruined by erosion while in corn—a soil-destroying crop on rolling or hilly land. Interlacing grass roots protect a hillside but cultivation permits the rich top soil to wash away

only way in which corn can be exported from these plateaus is by converting it into whisky or live stock Owing to the fact that the United States Government taxed whisky there was a long struggle between the collector of United States revenue and illicit distillers, "moonshiners" as they are called, of the Appalachian Mountains. The mountaineer feels that it is a tyranny for the Government to prohibit or to tax the only thing he can sell This feeling took its strongest form in Washington's administration, when the people of western Pennsylvania, objecting to the

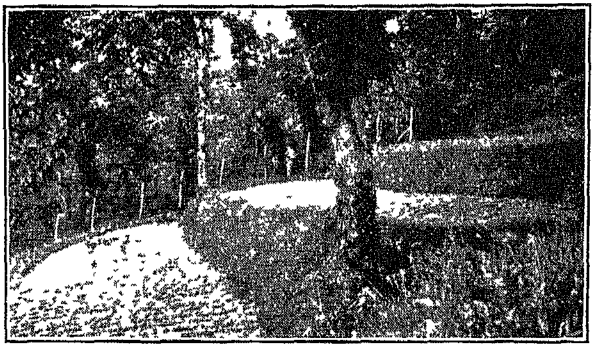


FIG 35 —Another hillside in Appalachia The soil has been thrown by the plow into broad, nearly-level terraces, retained by steeper banks of sod These steps check the run-off, while the sod holds the soil particles in place for the farmer's use

tax, arose in insurrection against the new Republic in the so-called "Whisky Rebellion"

Climatic requirements. Corn cannot stand frost, but will mature if there is a 5-months growing season, and a hot midsummer with sufficient rainfall (Fig 36) to keep up the growth of the plant Accordingly, regions with a cool summer, all North Europe, most of New England north of latitude 44°, and Canada, excepting a part of Ontario, cannot well produce a crop of ripened corn. Selection and breeding are producing quick-maturing strains, some of which will ripen in 90 days of growth. By this means the corn belt has been extended farther north The heat requirement of the maize plant includes warm nights as well as warm days, so that many arid regions having very hot days and cool nights, such as Nevada and the Pacific Slope are not suited to the

FIG. 36 —Rainfall in inches per month at Omaha The heaviest rainfall comes just when the growing corn needs it most Each horizontal line marks an inch

profitable production of corn despite an apparently satisfactory average temperature. For this reason it is not yet an important crop in the irrigated West but interesting variety adjustments are being tried out.

Although a lover of heat, corn does not do its best in the continuous heat of the tropics, the greatest yield of grain being in the central temperate zone The cultivation of corn in a small way is, however, widely scattered throughout the warmer

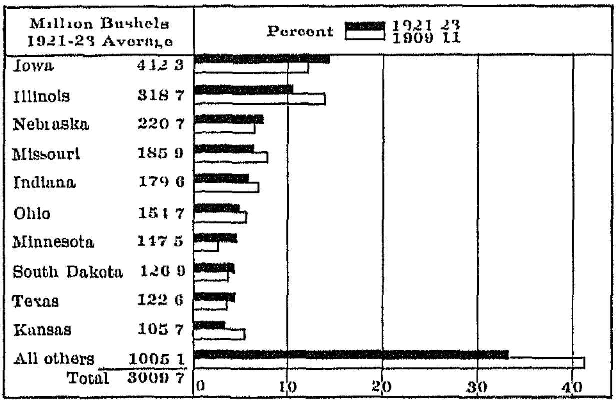


FIG 37.—United States corn production, three-year average

parts of the world between 45° north latitude and 40° south latitude.

Corn belts. The United States produces nearly three times as much corn as all the rest of the world (Fig 38). It is grown from the Gulf of Mexico to the Great Lakes, and from the Atlantic Ocean to western Kansas, and in scattered areas beyond, but the region of greatest production, the so-called American corn belt, reaches from central Ohio to central Kansas, and from central Missouri to Wisconsin. It includes nearly all of the states of Iowa, Missouri, Illinois, Indiana, and Ohio, and about half of Kansas and Nebraska (Fig 33). This region is one of the finest agricultural sections in the entire world. For hundreds of miles the almost level prairies are rarely varied by undulations steep enough to interfere with the laying out of roads on meridians and parallels at regular intervals of 1 mile. This soil that

lies so beautifully for tillage is naturally fertile, and so free from stones that the worker can ride the cultivator with which he tends the corn Some of these cultivators till both sides of one row of corn, and some of them even take two rows at once Thus, an unaided farmer with his team can cultivate a large area of corn, sometimes more than 40 acres, and produce the grain that was so wonderfully cheap for many years Serious droughts are infrequent in the corn belt. The abundant rainfall of summer comes in short showers which do not seriously interfere with agricultural operations, and the heat is sufficient to

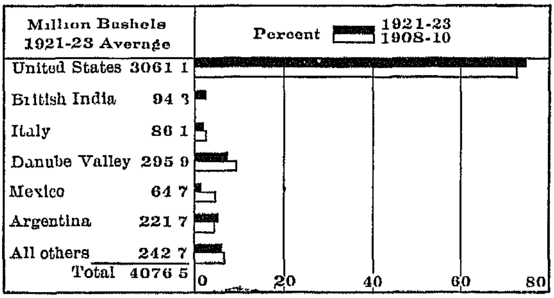


FIG 38 —World's corn production, three-year average

make a most excellent growth of corn. The percentage of sunshine, an important factor, is high

Relation of corn to other products of corn belt. Corn is not the only crop in the corn belt. On a single farm there may be, in addition to corn, fields of oats and hay which require the farmer's labor at different seasons from the corn, also there will often be a field of grass upon which cattle can graze.

It is estimated that man eats 88 per cent of the wheat grown in the United States, while 11 per cent is used for seed and 1 per cent fed to animals, the reverse is true of corn About 88 per cent of the corn crop is fed to animals on the farms where raised, and is sold in the more condensed forms of beef, pork, mutton, horses, and mules (Fig 40) The biggest corn-growing states are also the ones which market the major share of fat hogs and cattle

An interesting adjustment of production to transportation

factors is shown by the way distance decides whether the corn-belt farmer ships meat or grain In 1910, 48 per cent of the corn of Illinois, near St Louis and Chicago, was shipped out of the county where it was produced In Kansas the corresponding figure was 22 per cent, in Texas, yet farther from the markets, it was only 7 per cent

Corn in the South and East. Corn is the second crop in importance on the cotton lands of the South. Although these

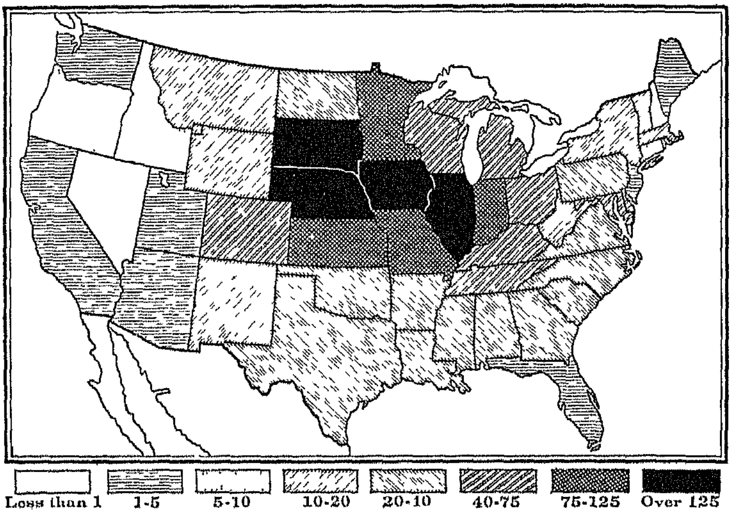


FIG. 39.—United States corn production in bushels per capita of rural population, three-year average, 1921–23. Population, 1920

lands are well adapted to corn growing, cotton is so overwhelmingly the main crop that the corn crop is often insufficient for local use, and import from the corn belt is necessary although this tendency is declining with the increase of diversification in the South Corn, but little used as human food in the northern half of the United States, is in common use in the southern states. Two shortcomings of corn suffice to explain its small use as breadstuff where wheat is available; first, it has no gluten and so will not make a dough, or light bread, second, the bread loses much of its palatability upon getting cold.

In the case of failure of her wheat crop, there would be famine in Italy without the import of grain In America we have the great reservoir resource of corn, not fully understood by many during the Great War. We grow three to four times as much of it per year as we do of wheat, sometimes more than that Nearly all of the corn is fed to our animals (see Fig. 40) In case of a

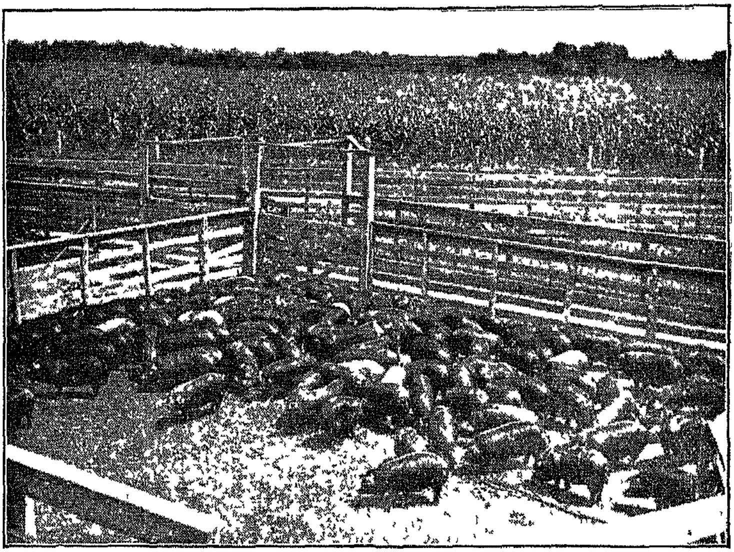


FIG 40—Iowa corn field and corn condensers, 140 hogs fed on corn and molasses feed, gained 1 2/3 lb each per day for 100 days (Champion Feed Milling Co, Lyons, Ia)

great shortage of wheat, all we need to do is to eat a fifth or a fourth of our corn and reduce temporarily our animal industries to that extent This would of course mean a reduction in the meat supply, but it would still leave us more meat than the people of any nation on the continent of Europe ate even before the World War

We made a tiny start in that direction during the war, by making a slight reduction of meat during our meatless days and mixing a little corn meal with our wheat flour We did not like the new bread, for people rarely like to make changes in their

diet. Even the hungry people of Europe often resented the eating of corn, which has nevertheless been the food for millions of people for thousands of years, and has now spread to all continents.

Corn is also an important crop in the Middle Atlantic States and its growth is extending to the northward This extension is aided by the use of the silo, a barrel-like structure, 10 to 20 feet in diameter and 30 to 50 feet high, made of wood or concrete (see Fig. 71). By means of the silo the entire corn plant, stalk,

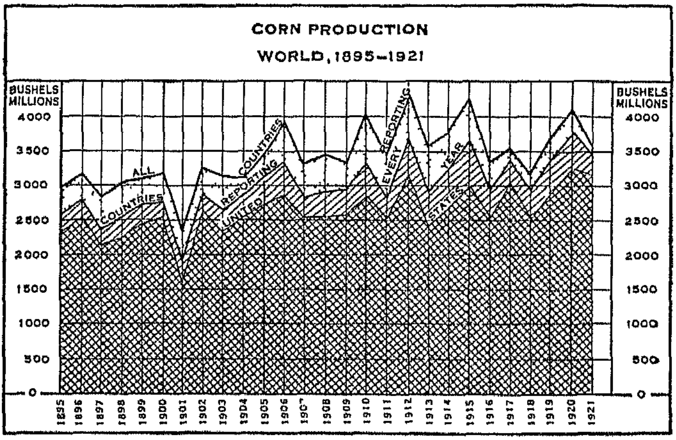


FIG 41 —The overwhelming importance of the United States in the world's corn production is clearly shown. (United States Dept Agr.)

leaf, ear and husk, when chopped into bits, may be kept moist, warm (from fermentation), and edible for cattle for 1 or 2 years, or even longer. In this form, called silage, corn yields its greatest possible food value for live stock, and is much used in the feeding of dairy and beef cattle Since it can be put away some weeks before it is fully matured, it can be grown much farther north than can the ripened grain. After the "roasting ears" or "green corn" have gone to the market or the cannery, the stalks are sometimes used in the silo for dairy cows.

The improvement and extension of corn growing. Great improvement in corn growing takes place from year to year as the scientific agriculturists teach the need of the plant, breed

new and better varieties, and select the seed to take advantage of the known laws of heredity Boys' corn clubs are doing much to increase the yield of corn By careful test in Illinois one large cornfield yielded 48 bushels to the acre while a similar adjacent field owned by the same man yielded 77 bushels to the acre, the

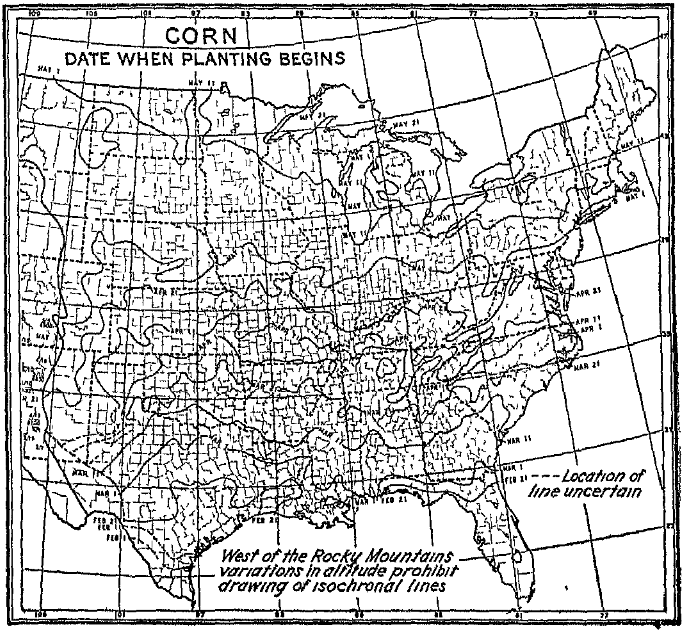


FIG 42 —Average dates of the beginning of corn planting Starting about Feb 1 in southern Texas, it advances northward at an average rate of 13 miles a day until the heart of the Corn Belt is reached about May 1 Here all the planting is usually completed by June 1 (United States Dept Agr)

only element of difference being the superior well-selected seed that produced the larger crop The breeding of earlier ripening kinds will doubtless make possible a greater growth of corn in parts of the northern United States and Canada where it is not now a dependable crop. South Dakota, long a wheat state, now grows four bushels of corn to every bushel of wheat, due in part to earlier varieties of corn.

New kinds of corn. Kaffir corn and Chinese sorghum are two of the new kinds of corn (so-called) that have recently been introduced to the United States with great benefit and greater promise Both are members of the sorghum family Like Durum wheat, they can stand much drought Kaffir corn comes from arid South Africa where the annual crop is half again as large as maize Others have recently come from the drier parts of China and they are already being grown by the millions of acres in Kansas and Oklahoma, where they have of late proved themselves more valuable per acre than the water-loving Indian corn The grains are small and round like little peas The appearance of the plants is like that of broom corn, but they are satisfactory stock food and are bringing about some westward extension of the corn area. They are also excellent human food as attested by the vigor of millions of Africans and Asiatics.

Questions

1 Why is the moist open winter of Washington state and England so good for wheat?

2 How does wheat thrive in the climate of the cotton belt? In that of the Great Valley of California?

3 How does the changeable winter weather of Illinois suit wheat?

4 How does the plant explorer increase our possible wheat production? The plant breeder?

5 Why was rye more important in Colonial America than it is now? Why was corn the agricultural mainstay of the American colonist?

6. How does a labor adjustment promote the growth of oats in the corn belt?

7 Why is corn the worst of all grains as a soil destroyer?

8 What quality of the barley plant promises to make it very important in the western half of the United States?

9. What has been the great American achievement in rice growing?

10 How does corn get to market?

11. How may the silo extend the zone of corn culture?

12. How have Kaffir corn and sorghum influenced the corn area?

fortunate fact, for many millions of the human race in Asia and Europe can rarely afford to eat meat because of their poverty It is a luxury possessed chiefly by the people of lands of sparse population, where for that reason meat is cheap (Fig. 43) Man always has the choice of eating plant products directly or, if land is cheap and plant products abundant, he can feed them to animals and then eat the animals The latter is much the more expensive form, for the making of a pound of meat requires the grass from much land, or it requires from 5 to 10 pounds of grain, the equivalent of eight to fifteen 1-pound loaves of bread In densely peopled regions where there is not food enough for both man and beast, man eats the vegetable food and does without the beasts

Japan probably presents the most extreme example of a numerous people who maintain a high civilization with few animals.

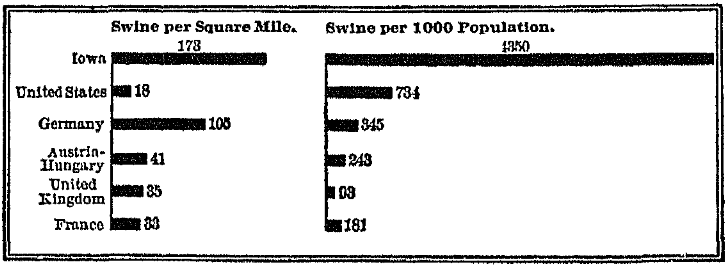


FIG 44—See legend for Fig 43 The numbers of swine per square mile will probably surprise many

With the exception of the cold northern Island of Hokushu, the whole country has a population of from 400 to 500 people per square mile. With over 55 millions of people, the Empire has of horses and cattle combined but five and one-half per cent as many, while the number of sheep and hogs is but one-eighth of one per cent of the number of people Both of these figures are utterly insignificant in comparison even to those of Europe. For the United States the ratios were 86 and 95 per cent, respectively, in 1923. (113 and 130 in 1913)

The rising price of meat. As long as the American people could keep on spreading into fresh new lands, animals were abundant and meat was cheap. By the beginning of the twentieth century we had come to the end of our new corn lands, and since

that time we have been exhausting the land we had and increasing our population so that animals are becoming relatively scarce.[1] That makes the price of meat rise and the relative scarcity seems likely to continue and even to increase because of these geographic reasons.

2. Swine

Swine are the meat animals of grain-growing lands as sheep are of grass-growing lands Thus pastoral New Mexico has but

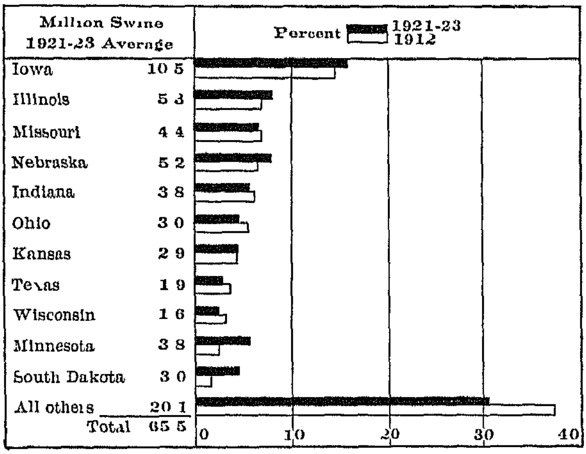


FIG 45 —United States distribution of swine, three-year average

one hog to twenty-three sheep, and Iowa, a great corn state, has eleven hogs to one sheep. The hog was originally an animal

[1] NUMBER OF ANIMALS PER 1,000 POPULATION IN THE UNITED STATES

	1903	1913	1923
Sheep	841	558	361
Hogs	617	665	618
Beef Cattle	587	391	397

(Using population of 1900, 1910 and 1920)

of forest countries, living upon acorns, nuts, roots, grubs, and other highly nutritious foods Consequently, in domestication he must have somewhat similar foods, since his small stomach is not adapted to a complete diet of bulky grasses. In his original forest home he converted the abundance of autumn nuts into a layer of fat which covered his body and carried him through the hungry time of winter Therefore, the rich grains of the farm suit him exactly He is still fond of the nuts and acorns of his original forest home, but is able to eat anything from a piece of meat or garbage to the weeds which his owner pulls from the garden Tame, harmless, hardy, and prolific[1] the hog is an admirable dooryard scavenger and meat producer for the cottagers of many lands, and has attained an almost world-wide distribution, being of great local importance as a food supply in many countries Where an abundance of food is possible the hog easily becomes a commercial product because he converts his food into meat more efficiently[2] than any other of our animals. Pigs are the only meat animals densely populated China can afford to raise.

Relation of the hog industry to grain growing. Since the hog must have some kind of concentrated food such as acorns, nuts, or grain, he is a natural product of the regions producing cheap grains. The chief regions producing hogs for export, therefore, are those in which corn or barley abound [Compare Figs 33, 45, and 53, showing distribution of swine and corn in the United States] Since corn has long been the cheapest and is also the most fattening of the grains, the corn belt of the United States has a greater relative advantage than any other large area in the world for the production of the cheapest of animal foods

[1] It is a rare flock of sheep that increases 100 per cent per year, while ten- to fifteen-fold increase of swine is common Their production in the United States and other countries is greatly hampered by the outbreak of the swine plague or hog cholera, a disease which the recently discovered process of inoculation seems able to hold in check

[2] The United States Department of Agriculture states that it takes about 6 pounds of grain and 6 pounds of hay to produce a pound of lamb (live weight); 10 pounds of hay and 10 pounds of corn to make a pound of beef, and 5.6 pounds of corn for a pound of pork Steers and sheep also lose from 35 to 50 per cent when butchered while the waste of a hog carcass is only 25 per cent.

—pork and lard It might as well be called the hog belt as the corn belt The farmer in Iowa, Kansas, or Nebraska nearly always grows one or two fields of corn, and usually keeps from a dozen to several hundred hogs, which he feeds almost entirely upon the corn. Fully one-third of the American corn crop goes to the market in the form of pork Hogs are reared to some extent in practically all parts of the United States, but chiefly where corn is grown (Fig. 37). On the Pacific Slope barley is

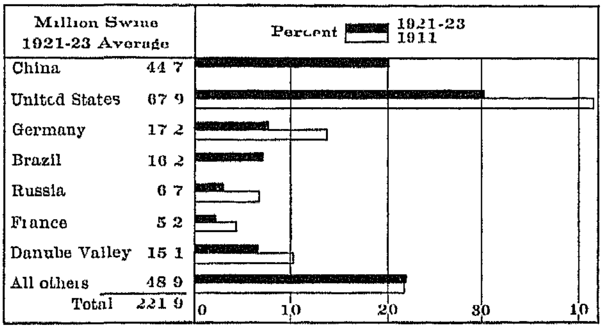


FIG 16 —World distribution of swine, three-year average

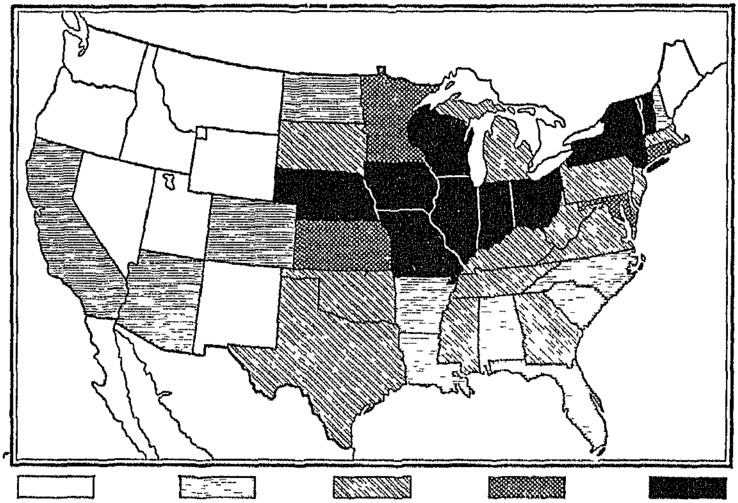
used to some extent as a substitute for corn Several hundred thousand hogs live on mast in the national forests and the mountaineers in parts of the Ozarks, the Appalachians and the cotton belt derive most of their meat supply from "razor back" hogs that shift for themselves and live entirely upon roots, nuts, acorns, and other forest pickings

3. CATTLE

Distribution of cattle. Wherever there are wide spaces of untilled grass lands we are likely to find cattle They were the animal pioneers during the nineteenth century upon the vast plains that the white man won from the wild animals and native peoples in North America, South America, Australia, and central Asia On account of their size, strength, and speed, they can combat dangers, or, if necessary, flee from them. Their ability to withstand heat and moisture has enabled them to go into lower latitudes than sheep With the exception of the

humid plains of the mid-tropics, they are to be found from the Straits of Magellan to Hudson Bay and from Siberia to Tasmania.

In the first stage of the occupation of new plains, before transportation has been well developed, the only export products furnished by cattle are the non-perishable hides and tallow. Later the bones are gathered up to make fertilizers to restore phosphorus to worn-out lands. However, the ability of cattle



Under 10 | 10-20 | 20-30 | 30-40 | Over 40

FIG. 47.—Cattle in the United States per square mile by states, Jan. 1, 1924.

to walk long distances enables them to be raised far from the railroad. Thus we had a vast area in the West which was for a time devoted to cattle under the care of the picturesque but now less numerous cowboys.

The great open plain west of the one hundredth meridian and reaching from west Texas far into Canada is too dry for good farming, therefore the pioneers farmer could not take it for homesteads, as they had taken up all Iowa and the eastern parts of Kansas and Nebraska. Hence, people branded their cattle, and turned them out upon the plain in great numbers to pick up their living as the buffalo had done. At an annual round-up all the cattle in a large area were brought together, each man

took the cattle that had his brand and sold them. The freedom of the range naturally led to overstocking. The grass, especially in periods of drought, was eaten so close that it could not produce seed, and in many places it died out and was replaced by inedible weeds The disappearance of the grass exposed the soil to erosion by both wind (blowholes) and water (Fig 49) so that the plains cannot now support so many cattle as they once did.

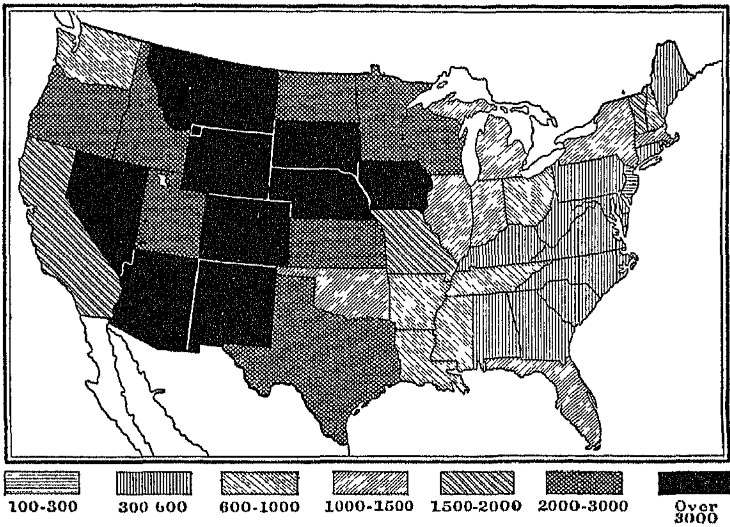


FIG 48—Cattle in the United States per 1000 rural inhabitants, by states, Jan 1, 1924 Population, 1920

Among the other changes now taking place in the cattle-ranching methods of the West, are the passing of much land into private ownership and the fencing of the free range Many of the huge ranches which contained thousands of acres, are being cut up into smaller units, and forage crops supplement cattle raising. The lean Texas longhorn has been displaced by the better grades of pure bred beef cattle, and the industry is becoming more careful and scientific

The migration of beef cattle. The range cattle spend one or two years upon these western plains living on grass, and are then shipped lean and hungry into the corn belt where the farm-

ers keep them for a few months, fattening them on corn before sending them off to the great markets for slaughter Some of these cattle are fattened on the farms as far east as Pennsylvania and other Atlantic states. In the hilly country of southwestern Virginia, West Virginia and northeastern Tennessee, there is a section of good grass country where young cattle are raised and

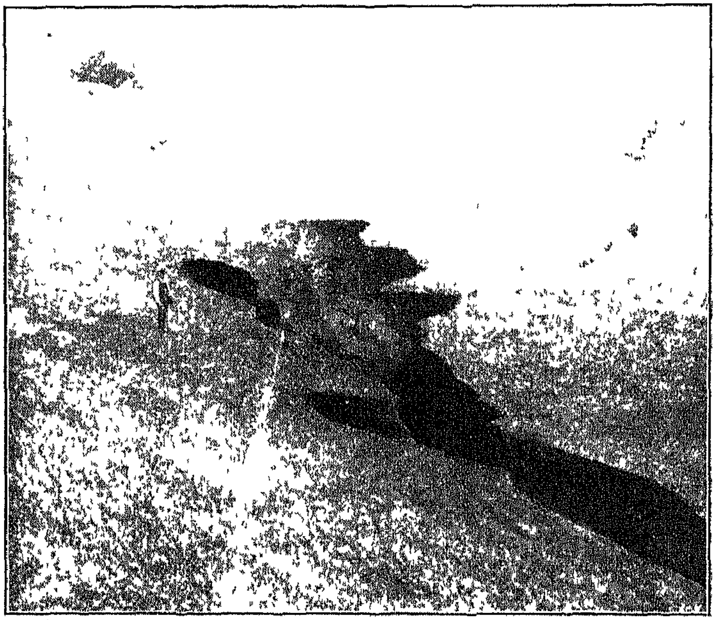


FIG 49—Erosion of California pasture land after too close pasturing, Marin County Great resource destruction follows abuse of pastures (Photo G. K. Gilbert)

sent to the farm lands of the great valley and the Piedmont sections of Virginia and Maryland for fattening.

This migration of the animals in their production and in their going to market provides easy means for the rapid spread of diseases Within recent years there have been bad outbreaks of the foot and mouth disease, a terrible disease usually fatal to all cattle. It has swept the cattle away by hundreds of thousands in South America and Africa, and occasionally the germs come

with hides to this country. An infection from stockyards of Chicago and Buffalo has been spread over many districts by the scattering of cattle to be fattened on eastern farms. We have thus been compelled to establish rigorous and efficient quarantine regulations, carried out by the Bureau of Animal Industry, of the United States Department of Agriculture.

Importance of cattle on arid lands with some irrigation. Irrigation in the West is important to the cattle industry (Figs. 48 and 54). Indeed, beef is the chief commodity shipped

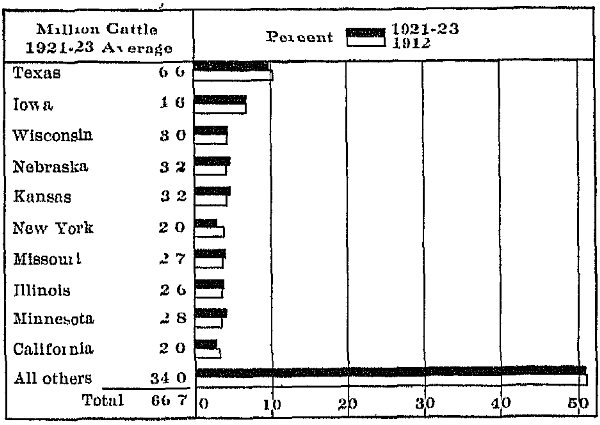
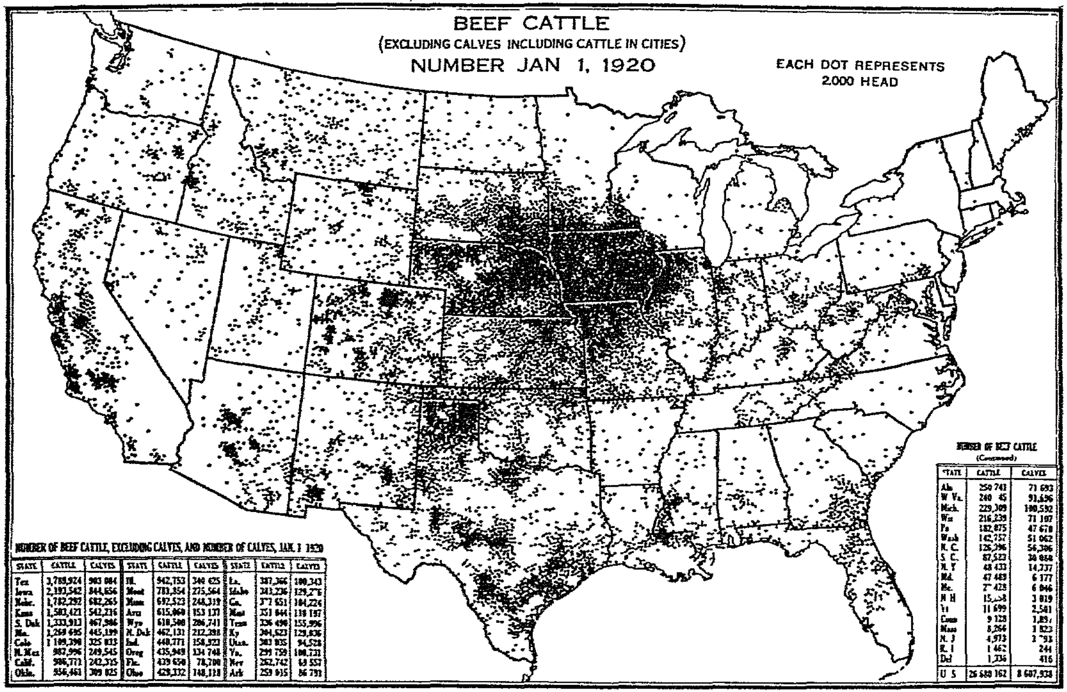


FIG 50 —Cattle, including dairy cows, in United States, three-year average.

from most of the irrigated districts of the United States. Alfalfa leads all other irrigated crops in the area under cultivation This plant is the richest of all the clovers. It sends its roots to great depths in the ground and when the moisture supply is abundant it yields heavy crops of hay, in from two to ten cuttings a year, according to climate Fortunately, the irrigable valleys are widely scattered throughout the cattle range from Canada to Mexico, and from western Kansas to western Oregon, so that these favorable alfalfa fields are really scattered oases in the scanty and semi-arid pastures. During winter and the seasons of drought, alfalfa hay supplies the cattle from the ranges with abundant food and sometimes fattens them for market



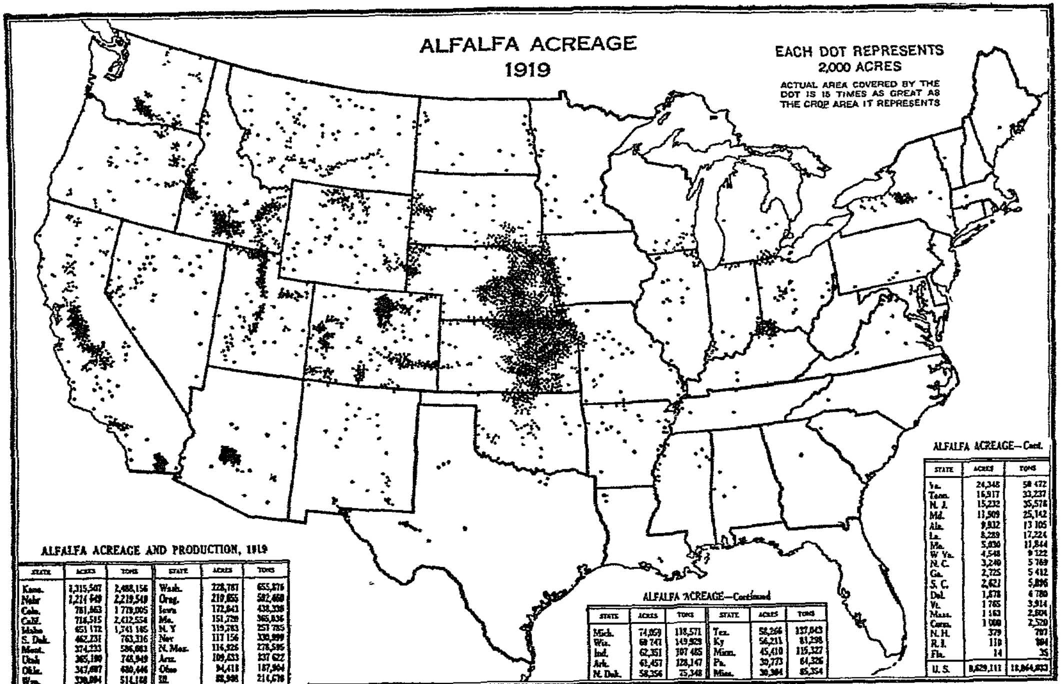
NUMBER OF BEEF CATTLE, EXCLUDING CALVES, AND NUMBER OF CALVES, JAN. 1 1920

STATE	CATTLE	CALVES	STATE	CATTLE	CALVES	STATE	CATTLE	CALVES
Tex	3,788,924	903 084	Ill.	942,753	340 625	La.	337,366	100,343
Iowa	2,193,542	844,656	Mont	783,354	275,564	Idaho	343,236	129,276
Nebr.	1,782,292	682,265	Minn	692,523	248,319	Ga.	377 651	104,224
Kans	1,583,421	542,216	Ariz	615,060	153 137	Miss	351 044	138 197
S. Dak	1,333,913	467,986	Wyo	610,508	206,741	Tenn	336 490	155,996
Mo.	1,269 695	445,199	N. Dak	462,131	212,398	Ky	304,523	129,836
Colo	1 109,398	325 033	Ind.	448,771	154,523	Utah	303 035	94,528
N. Mex	987,996	249,545	Oreg	435,949	134 748	Va.	299 759	100,721
Calif.	986,773	242,335	Fla.	439 650	78,708	Nev	282,742	63 557
Okla.	856,461	309 025	Ohio	428,332	148,118	Ark	259 915	86 793

NUMBER OF BEEF CATTLE (Continued)

STATE	CATTLE	CALVES
Ala	250 743	71 693
W Va.	240 45	93,696
Mich.	229,309	100,592
Wis	216,239	71 197
Pa	182,875	47 678
Wash	142,757	51 062
N. C.	126,396	56,306
S. C.	87,523	30 858
N. Y	48 433	14,737
Md.	47 489	6 377
Me.	27 423	6 846
N H	[illegible]	3 019
Vt	11 699	2,541
Conn	9 128	[illegible]
Mass	8,266	1 823
N. J	4,973	3 793
R. I	1 462	244
Del	1,336	416
U S	26 680 162	8 607,938

FIG 51 —Cattle from western ranges stop in western Corn Belt to get fat Compare with FIG 52, irrigation alfalfa and cattle go together in much of the far west (United States Dept Agr)



ALFALFA ACREAGE AND PRODUCTION, 1919

STATE	ACRES	TONS	STATE	ACRES	TONS
Kans.	1,315,507	2,488,156	Wash.	228,787	655,876
Nebr	1,214,949	2,219,540	Oreg.	210,855	582,460
Colo.	781,863	1 779,005	Iowa	172,841	438,336
Calif.	716,515	2,412,554	Mo.	151,728	365,836
Idaho	651 172	1,741 185	N. Y	119,783	257 785
S. Dak.	462,231	763,316	Nev	117 156	330,899
Mont.	374,233	586,083	N. Mex.	116,326	278,595
Utah	365,190	748,949	Ariz.	109,633	337 622
Okla.	347,087	680,446	Ohio	94,418	187,964
Wyo.	330,884	514,148	Ill.	88,968	214,678

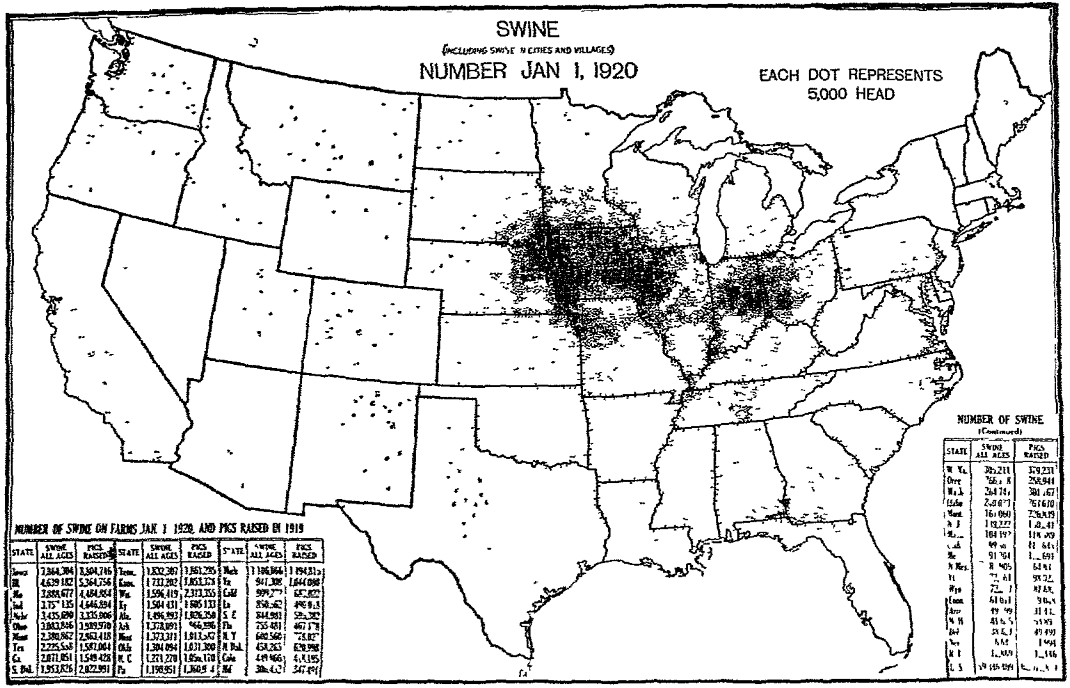
ALFALFA ACREAGE—Continued

STATE	ACRES	TONS	STATE	ACRES	TONS
Mich.	74,059	138,571	Tex.	58,266	137,043
Wis.	68 747	149,929	Ky	56,211	81,298
Ind.	62,351	107 485	Minn.	45,410	115,327
Ark.	61,457	128,147	Pa.	30,773	64,326
N. Dak.	58,356	75,348	Miss.	30,304	85,354

ALFALFA ACREAGE—Cont.

STATE	ACRES	TONS
Va.	24,348	58 472
Tenn.	16,917	33,237
N. J.	15,232	35,578
Md.	11,509	25,142
Ala.	9,932	13 105
La.	8,289	17,224
Me.	5,030	11,844
W Va.	4,548	9 122
N. C.	3,240	5 769
Ga.	2,725	5 412
S. C.	2,621	5,896
Del.	1,678	4 780
Vt.	1 765	3,914
Mass.	1 163	2,604
Conn.	1 000	2,520
N. H.	379	797
R. I.	110	304
Fla.	14	35
U. S.	8,629,111	18,864,833

FIG. 52 —The sudden ending of alfalfa near the Missouri river is a clear cut response to increasing rainfall which enables clover and timothy to replace alfalfa (United States Dept Agr)



NUMBER OF SWINE ON FARMS JAN 1 1920, AND PIGS RAISED IN 1919

STATE	SWINE ALL AGES	PIGS RAISED	STATE	SWINE ALL AGES	PIGS RAISED	STATE	SWINE ALL AGES	PIGS RAISED
Iowa	7,864,304	8,304,746	Tenn.	1,832,307	3,361,295	Mich	1,106,866	1,194,31[illegible]
Ill	4,639,182	5,364,756	Kans.	1,733,202	1,853,373	Va	941,308	1,644,080
Mo	3,888,677	4,484,884	Wis	1,596,419	2,313,355	Calif	999,277	657,827
Ind	3,757,135	4,646,894	Ky	1,504,431	1,886,133	La	850,562	490,913
Nebr	3,435,690	3,335,906	Ala.	1,496,993	1,826,358	S C	844,981	595,302
Ohio	3,083,846	3,989,970	Ark	1,378,093	966,596	Fla	755,481	467,378
Minn	2,380,862	2,963,418	Miss	1,373,313	1,913,567	N Y	680,560	73,827
Tex	2,225,558	1,587,084	Okla	1,304,094	1,031,300	N Dak	458,263	628,998
Ga	2,071,051	1,549,428	N C	1,271,270	1,856,170	Colo	449,466	[illegible]
S Dak	1,953,826	2,022,991	Pa	1,198,951	[illegible]	Md	[illegible]	347,491

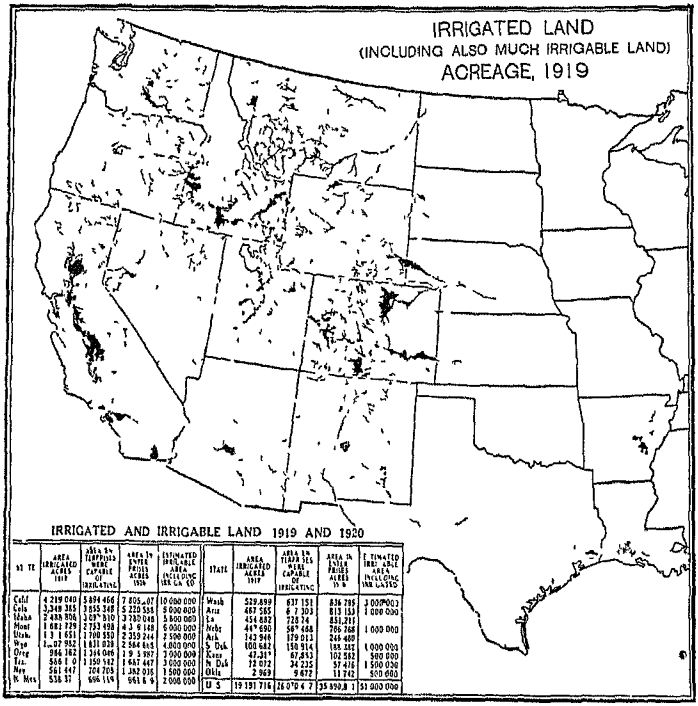
NUMBER OF SWINE (Continued)

STATE	SWINE ALL AGES	PIGS RAISED
W Va	[illegible]	379,231
Oreg	[illegible]	258,941
Wash	[illegible]	[illegible]
Idaho	[illegible]	[illegible]
Mont	[illegible]	[illegible]
N J	[illegible]	[illegible]
Mass	104,197	[illegible]
Utah	[illegible]	[illegible]
Me	91,704	[illegible]
N Mex	[illegible]	[illegible]
Vt	[illegible]	[illegible]
Wyo	[illegible]	[illegible]
Conn	[illegible]	[illegible]
Ariz	[illegible]	[illegible]
N H	[illegible]	[illegible]
Del	[illegible]	[illegible]
Nev	[illegible]	[illegible]
R I	[illegible]	[illegible]
U S	[illegible]	[illegible]

FIG. 53.—Compare this with the corn map. Corn and swine go together. (United States Dept Agr.)

4 Possible Extension of Meat Production

Cattle in southern states. The southern states have great, though little appreciated, cattle-producing possibilities. The northern farmer must build large barns to protect his animals



STATE	AREA IRRIGATED ACRES 1919	AREA ENTERPRISES WERE CAPABLE OF IRRIGATING	AREA IN ENTERPRISES ACRES 1920	ESTIMATED IRRIGABLE AREA INCLUDING IRRIGATED	STATE	AREA IRRIGATED ACRES 1919	AREA ENTERPRISES WERE CAPABLE OF IRRIGATING	AREA IN ENTERPRISES ACRES 1920	ESTIMATED IRRIGABLE AREA INCLUDING IRRIGATED
Calif	4 219 040	5 894 466	7 805 407	10 000 000	Wash	529,899	637 151	836 795	3 000 000
Colo	3,348 385	3 855 348	5 220 538	5 000 000	Ariz	467 565	6 7 303	813 153	1 000 000
Idaho	2 488 806	3 09 810	3 780 048	3 600 000	La	454 882	728 74	851,211	
Mont	1 681 729	2 753 498	4 3 9 148	6 000 000	Nebr	44 690	56 468	786 268	1 000 000
Utah	1 3 1 651	1 700 550	2 359 244	2 500 000	Ark	143 946	179 013	246 480	
Wyo	1 07 982	1 831 039	2 564 463	4 000 000	S Dak	100 682	150 914	188 387	1 000 000
Oreg	986 162	1 344 046	1 9 5 987	3 000 000	Kans	47,31	67,853	102 582	500 000
Tex.	586 1 0	1 150 542	1 687 447	3 000 000	N Dak	12 072	34 235	57 476	1 500 000
Nev	561 447	704 705	1 382 016	1 500 000	Okla	2 969	9 672	11 742	500 000
N Mex	538 37	696 119	961 6 4	2 000 000	U S	19 191 716	26 0 0 4 7	35 890,8 1	51 000 000

Fig 54.—Irrigation can turn a desert waste into a green oasis where alfalfa and other forage crops fatten our live stock. See Figs 51 and 52 (United States Dept Agr)

and their food from the cold and storms of winter He must feed his animals full half the year from the results of his summer's toil. In Alabama or Florida there is so little winter that a barn is scarcely necessary, and the growing season is so much longer that more forage can be produced on a given piece of land than in the northern states. The cattle can also pasture nearly all

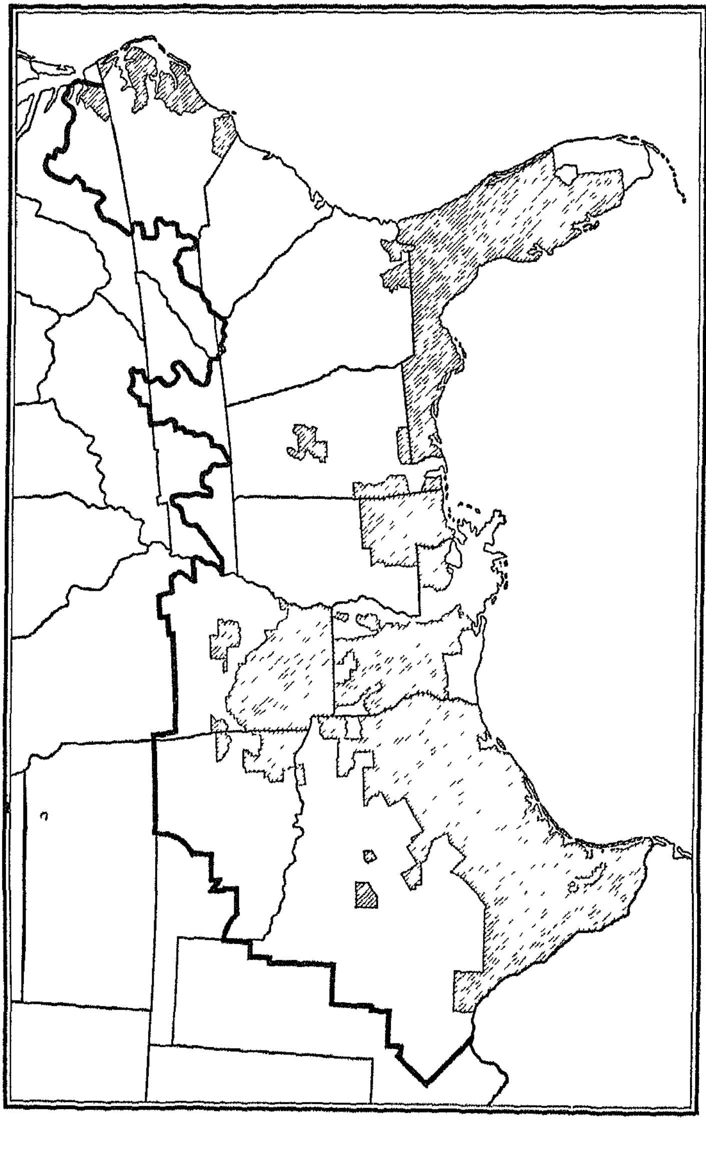


FIG 55.—The heavy line marks the original battle front of quarantine against the tick The shaded areas now show all that is held by the retreating foe who fights by the futuristic method of spreading germs (United States Dept Agr)

the year. Thus the industry requires less capital than in the North but as much or more labor One serious disadvantage to the cattle raisers in the South has been the tick, a parasite which abounds in the timbered districts and which is often carried to other distant areas by shipped cattle These ticks, which cling to the skin of the animal in great numbers, not only keep the animals thin by sucking their blood, but often transmit the germ of "Texas fever," a cattle disease often fatal But successful methods of tick eradication are steadily doing away with this danger (Fig 55) even in the worst infested districts Hence the South should rapidly take its place as the leading cattle-producing region of America

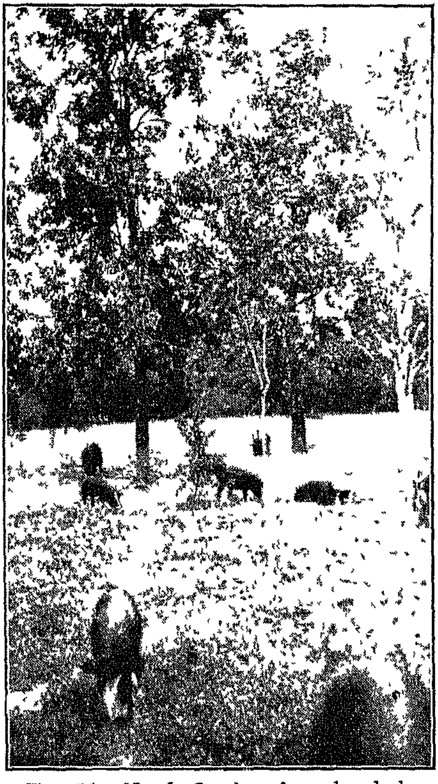


FIG 56—North Carolina farm hands harvesting the persimmon crop in September In July they made a path to the mulbery tree at the extreme right (Photo by J Russell Smith)

The South has even greater advantages for hog production than for cattle production. In the Gulf and South Atlantic states it is possible to grow at nearly all seasons of the year a great variety, and an almost complete succession of forage plants which the hogs can eat in the field without the trouble of harvesting by human effort Some of these crops are Japanese cane, alfalfa, red clover, crimson clover, cowpeas, soy beans,

wheat, oats, winter barley (for pasture), and vetches The last four are not injured by frost and will grow four-fifths of the time in the open winters of the Gulf Slope (see also Fig. 56)

5. The Effect of Improved Methods of Shipping and Preserving Meat

The invention of artificial refrigeration (Fig 57) has done much to make possible the slaughtering of animals nearer the place where they were raised Previous to the development of refrigeration the

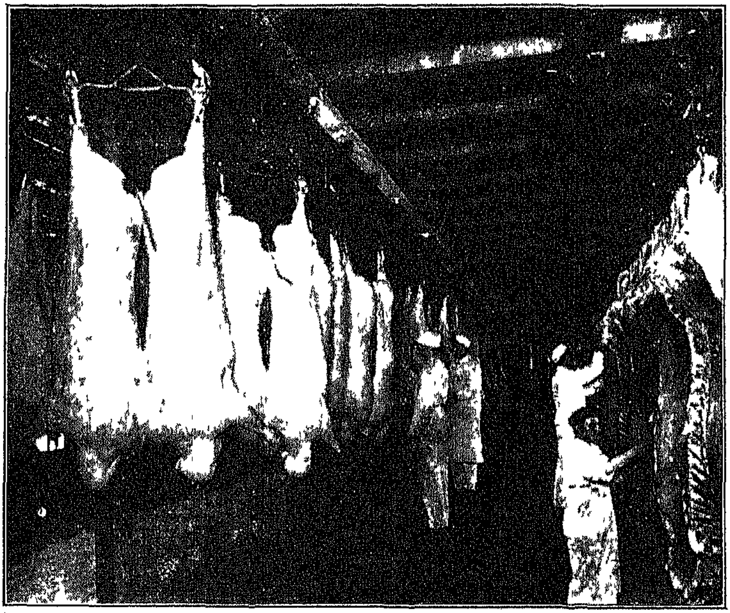


Fig 57—United States Federal inspectors examining meats in a packing house (United States Dept Agr.)

meat of animals suitable for beef was thrown away in some sections, and only the hides, horns, and tallow saved. About 1875 the invention of the refrigerator car made it possible to send dressed beef from Chicago to Boston more cheaply than the live animals could be sent. In 1879 came a sure method of hermetically

sealing meat in cans so that it would keep for a long period, thus giving another force to locate the slaughtering industry at the great cattle markets rather than at the centers of consumption. Consequently, packing plants are located in the great cities nearest to the places where the cattle are fattened. Cincinnati and Chicago were the first packing house centers, but St. Louis, Omaha, Kansas City, and, to a lesser extent, Sioux City and St Paul, have now become great centers. Plants have been built also at Fort Worth and Waco in northern Texas still nearer to the cattle-raising districts, but Chicago is yet, as it has long been, the greatest meat-packing center in the world, partly because of its favorable location at the junction of many transportation lines both by rail and water, and partly because it had an early start in the business and so has developed a class of men specially trained in the skillful management of what has come to be a many-sided industry.

The modern meat-packing plant handles cattle, hogs, or sheep, according to the demands of the market, and is one of the most wonderful examples existing of speed, mechanical perfection, and the use of by-products So perfect is the utilization of the refuse that absolutely nothing is wasted. The meat product of the packing house goes out as fresh, salt, smoked, canned, or pickled meat. Grease not fit for culinary use is made into soap All other parts not otherwise used, are made into fertilizer The total number of inedible products is over 100. Owing to the development of cold storage and refrigerator cars, an ever-increasing proportion of fresh meat is now distributed from the great packing centers to cities and small towns, chiefly in the northeastern section of the United States It is also put into the chilled chambers of the ocean steamers at the Atlantic ports, and sent to Liverpool, London, Antwerp, and Hamburg to feed the dense populations of Europe There is a considerable export of pork to the West Indian Islands and other tropical countries. For this trade salt pork has the advantages of being cheap and of keeping well. Our export of meat products declined sharply before the war and after it Argentina has shipped us fresh meat in 1913 and since the war, in spite of our import duty of 3 cents a pound.

The future supply and price of meat. The nineteenth century was a period of industrial discovery and commercial expansion by means of farm and factory machinery, railways, steamboats and refrigeration This permitted the western world to have for a few decades the cheapest meat supply we are ever likely to have while our civilization holds together. There are no more great plains to discover in America or elsewhere, and the population is increasing much faster than the number of meat animals. As a result meat is to-day rising in price in practically all parts of the world The price oscillations of the World War and after should be regarded as temporary phenomena in a great general movement For high meat prices there is no remedy in sight, and it may not be an entirely fanciful prediction that fifty years hence a juicy beefsteak will be the centerpiece at the banquet table

6. Hay

Relation of hay to the animal industries. Grass is the natural food of most of our domesticated quadrupeds Pastures or grass fields where animals can feed in summer are the commonest feature of American farms. Hay, the dry grass or pasture product, kept over in barns or stacks for winter use, is almost equally common. In the harvesting of this crop we see one of the direct results of intermittent climate which stops growth. It is not necessary to make hay in lands where grass will grow the year round, as it does in many parts of the torrid zone Hay is usually a supply crop, to be eaten by the animals of the farm and becomes salable in the form of live animals, meat, butter, cheese, milk, wool, and hides Every time one eats any of these foods he uses a commodity that could not have been produced in usable quantities but for hay, and when there is a shortage in hay, dairy products and meat are high in price.

Distribution of hay production. In the semi-arid regions, like the Great Plains of the central part of America, nature herself makes good hay Here the rain comes in the early summer making the grass grow rapidly With the increasing dryness of late summer, the grass dries and stands for months rich and nutritious.

The cultivated hay crop is general in the north temperate zone and also in parts of the south temperate zone, except on the natural hay plains; and it is increasing rapidly in irrigated sections In the United States, Canada, and Europe it is a very important crop. It even exceeds the wheat crop in value in the United States, and about equals it in area.

In the United States the corn belt is the great hay center also, a fact which shows very clearly that zones producing one farm

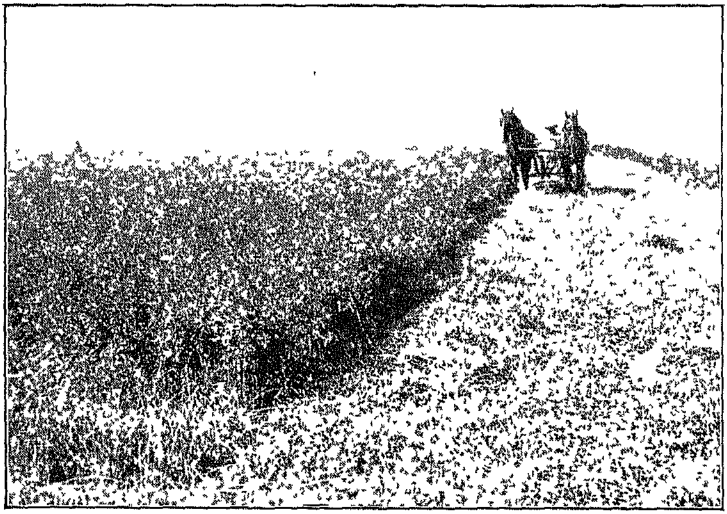


FIG 58 —Cutting irrigated alfalfa in Montana Third crop of the season, with yield of two tons per acre (United States Reclamation Service)

crop only are not common The average corn belt farm raises corn, some small grain such as oats, wheat, or barley, and a field of hay for winter use, besides another field for summer pasture.

Methods of making hay. Methods of making hay have greatly improved through the recent invention of machinery So great is the saving of labor (Fig 59) that, in some of the alfalfa fields of the West, it is said that hay could be made at a labor cost of $1 per ton, before the World War upset prices. Being one of the best of animal foods, it enabled the productive alfalfa lands to bring a very high price for American farm lands

Hay in irrigated sections. The most productive of all hay plants is the alfalfa, a clover which lives for many years, which can slumber through months of drought, and spring into rapid growth the very day that water is applied, and can produce five or six tons of hay per season in three or more cuttings on rich irrigated land. It succeeds at altitudes ranging from below sea level in the Imperial Valley, California, to 8,000 feet above the sea in the mountains of Colorado To crown its virtues, alfalfa hay

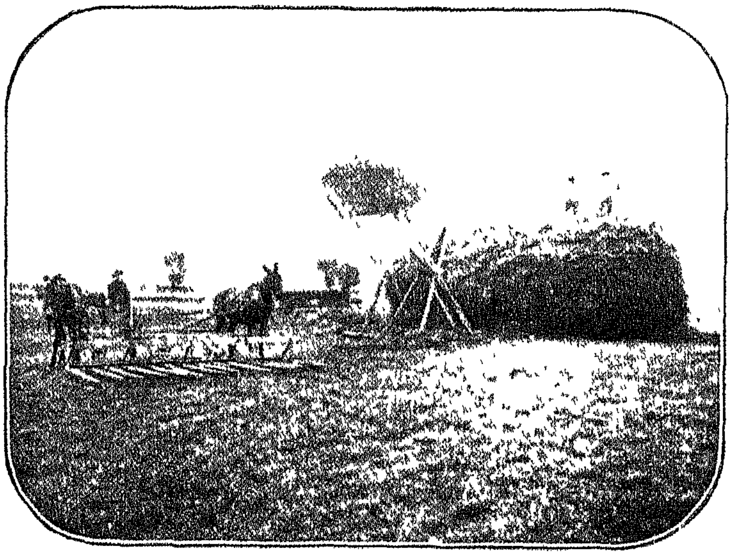


FIG 59 —By the use of these devices alfalfa hay is cut, gathered and thrown upon the rick without wagon or pitchfork, or the force of human muscle (United States Reclamation Service)

is richer in protein than is wheat flour. Hay, therefore, reaches great importance in the irrigated districts (Fig 54) interspersed among the arid and semi-arid lands of the West, where in some places alfalfa alone makes satisfactory stock raising possible

Hay in commerce. The bulkiness of hay in proportion to value makes it comparatively unknown in foreign commerce. Our domestic hay movement is much larger than is the foreign Hay is regularly sent from the corn belt to the cotton belt, where

in a region that might produce forage for its own animals and a surplus for export, the people are devoting themselves so exclusively to cotton growing that they frequently buy food for their work animals Hay is also of considerable importance in local commerce in various parts of America where horses work in cities, in mountainous regions or forest regions, as at lumbering and mining

The many cities of New England and the northeastern states help to make this area the one with the greatest relative depend-

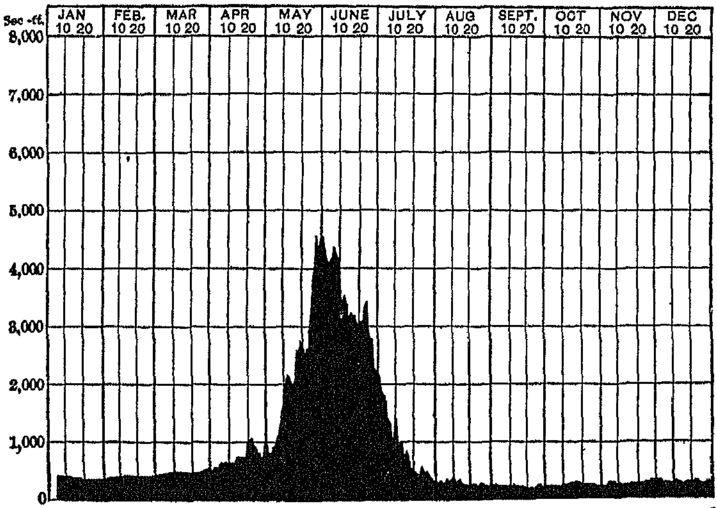


FIG 60 —Discharge of water in 1900 from the Arkansas River, a stream fed by Rocky Mountain snow, near Canyon, Colo (United States Geol Surv) The maximum of water in the growing season is very valuable in raising alfalfa and other irrigated crops which are so important in supporting our animal industry.

ence upon hay. It is chiefly fed to the dairy cow and in New York and New England it occupies 70 per cent of the total crop area In many districts of New England it is almost the only crop grown on many half-abondoned farms where no fields are being plowed

7 Dairy Products

The dairy products and their uses. Milk, intended by nature only for the offspring of the particular species producing it, has

been taken by man at various times and places from many animals. As a result of long selection and improvement, the goat and the cow have become especially adapted for this service The breeds of cattle are of two classes—the beef animals that tend to get fat if well fed, and the dairy or milk breeds that tend to give much milk if well fed The dairy products are first raw milk and then a number of manufactures of milk, chiefly cheese, butter, and condensed milk Cheese, a condensed form of milk, is a substitute for meat (see table of food analyses, appendix), and butter is a fat, supplying well the deficiency of the albu-

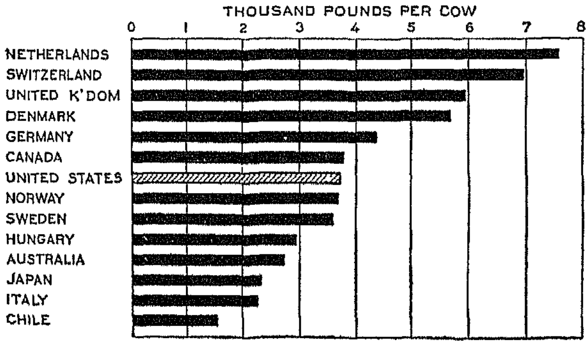


FIG. 61.—Average milk production per cow in different countries. (United States Dept Agr)

minous and starchy foods This is the reason we like it so well with bread

That part of the fat of milk which separates as cream can be condensed into lumps of butter by mere stirring at proper temperature, and kept for weeks, or in cold storage for months, the milk can be converted into white fleecy curds and the curds into cheese which keeps for months, and, by the driving off of water by the processes called condensation and evaporation, milk can be reduced in bulk and canned like fruit so that it will keep for years It can also be reduced to a powder Thus, many parts of the world hitherto unaccustomed to dairy products have, since the development of world commerce, adopted their use.

Characteristics and location of the dairy industry. Dairying as a world industry depends entirely upon cow's milk It has

aiisen in lands of moderate coolness wheie the rainfall is sufficient to make the succulent grass and other forage required by cows giving profitable quantities of milk Owing to the bulk, weight, and perishable natuie of milk, it must be produced near to the maiket if it is to be consumed while fresh Thus populous New York long led all other states in its number of daiiy

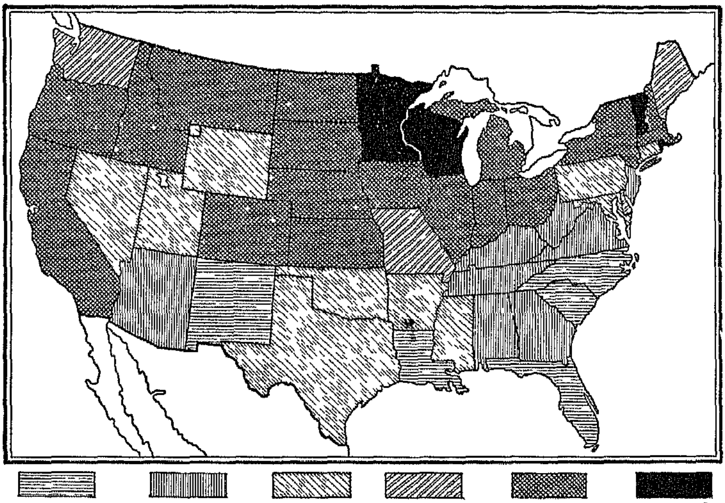


FIG 62 —Dairy cows in the United States per 1000 rural inhabitants, by states, Jan 1, 1924 Population, 1920

cows, and Pennsylvania, second in population, ranks high in dairy cows

Within a few decades great improvements have been made in the process of manufactuie of daiiy products, and like cloth making, it has passed from the home to the factoiy

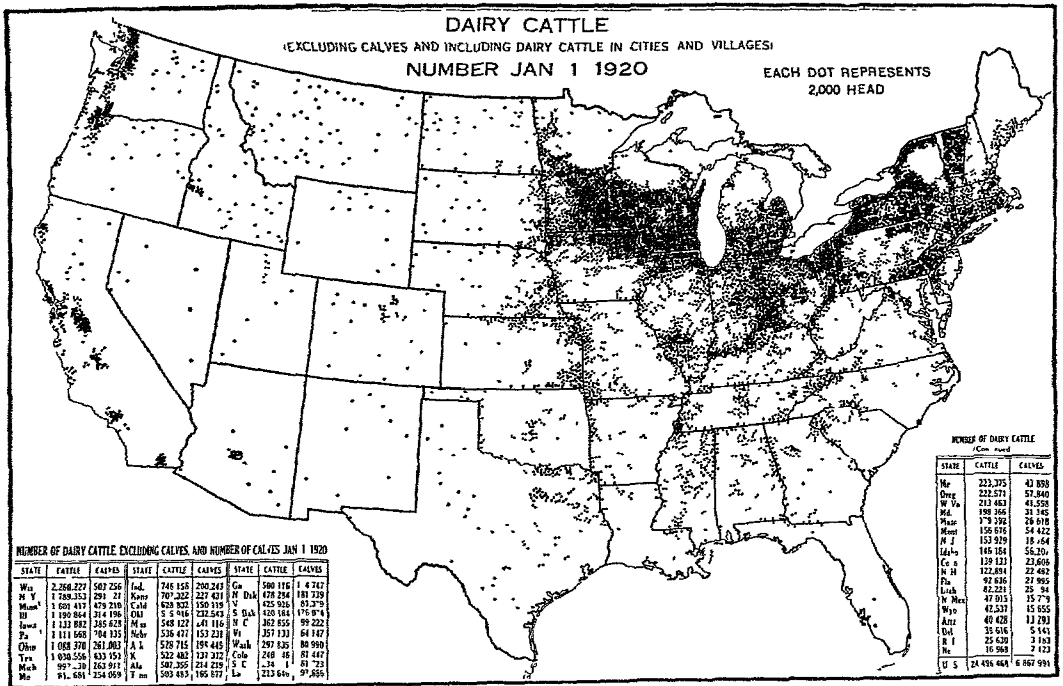
Dairying marks an important stage in the intensification of agriculture, which means increasing the income fiom a given piece of land. There are two ways by which a farmer may get more product one is to take more land, the other to put more care and labor on the land he has Upon the Great Plains with their scanty population there are millions of cows, but the available butter, milk, and cheese are inadequate for the use of the

people, because the cow, with little care from her owner, is allowed to run upon the great range with the calf which drinks all of her milk. In this instance the farmer makes his profit by selling beef In New York and other eastern states, on the other hand, the land is hilly, the farms are small, and the farmer cannot raise enough beef cattle to support him But a few cows eating his pasture grass, his hay, his corn fodder, or silage and much of his grain will, day by day produce enough milk to make him a comfortable income

New York State and most of New England besides shipping vast quantities of market milk, also rank high in the manufacture of butter and condensed milk These latter products, concentrated and easy to transport, tend to come from locations somewhat remote from the large cities, and their production is moving westward into the corn belt, and especially northwestward into the wheat belt, gradually replacing the less intensive meat and grain industries (Fig 62).

Wisconsin, passing New York, now leads in dairying, while Minnesota and the Dakotas are steadily growing Wisconsin and the lower peninsula of Michigan developed a dependence upon dairy products earlier and to a greater degree than the states of the corn belt proper because their land is not quite so well situated for corn, and therefore the people have been compelled to turn earlier from grain growing and make their land profitable by other means, such as potato growing and dairying. In Wisconsin, the State University has, through its school of agriculture, given a conspicuous aid to the dairy industry by inventions, investigations, and teaching throughout the state. Wisconsin alone produced two-thirds of the cheese made in this country in 1923.

It is a surprising fact that the United States with all its land and agricultural wealth has not become an important exporter of dairy products (see appendix). We have the land, but we have so much of it that we have not yet been compelled to use it so intensively as the dairy industry compels. Dairy exports are often a sign of meager agricultural opportunity per man, as in Denmark, Holland and Switzerland. In countries where the opportunities are greater as in New Zealand, Canada, and Argentina, butter and cheese may still be the best concentrated money crop



NUMBER OF DAIRY CATTLE EXCLUDING CALVES, AND NUMBER OF CALVES JAN 1 1920

STATE	CATTLE	CALVES	STATE	CATTLE	CALVES	STATE	CATTLE	CALVES
Wis	2,260,227	503 256	Ind.	746 158	200,243	Ga	580 116	1 4 747
N Y	1 789,353	291 21	Kans	707,322	227 431	N Dak	478 254	181 739
Minn	1 601 417	479 210	Calif	628 832	150 339	V	425 926	83,3'9
Ill	1 190 864	314 196	Okl	5 5 916	232,543	S Dak	420 184	176 0'4
Iowa	1 133 882	385 628	Miss	548 127	[illegible] 116	N C	362 655	99 222
Pa	1 111 668	704 135	Nebr	536 477	153 238	Vt	357 133	64 147
Ohio	1 068 370	261,003	Ark	528 715	19' 445	Wash	297 835	80 990
Tex	1 038,556	433 151	K	522 482	137 312	Colo	248 46	81 447
Mich	997 30	263 913	Ala	507,355	214 219	S C	34 1	61 723
Mo	81 681	254 059	Tenn	503 483	165 877	La	233 640	97,686

NUMBER OF DAIRY CATTLE (Continued)

STATE	CATTLE	CALVES
Me	223,375	43 898
Oreg	222,573	57,840
W Va	213 463	43,558
Md.	198 366	31 345
Mass	179 392	26 618
Mont	156 676	54 422
N J	153 929	18 [illegible]64
Idaho	146 184	56,20[illegible]
Conn	139 133	23,606
N H	122,894	22 482
Fla	92 636	27 995
Utah	82,228	25 94
N Mex	47 015	15 7'9
Wyo	42,537	15 655
Ariz	40 428	13 293
Del	35 616	5 543
R I	25 630	3 153
Nev	16 968	7 123
U S	24 496 469	6 867 991

FIG 63 —The greatest centers of dairy production are Wisconsin and New York, but the industry is spreading into adjoining states. (United States Dept Agr)

to ship long distances Thus New Zealand, a moist land of rich pastures, has recently become the world's greatest exporter of dairy products

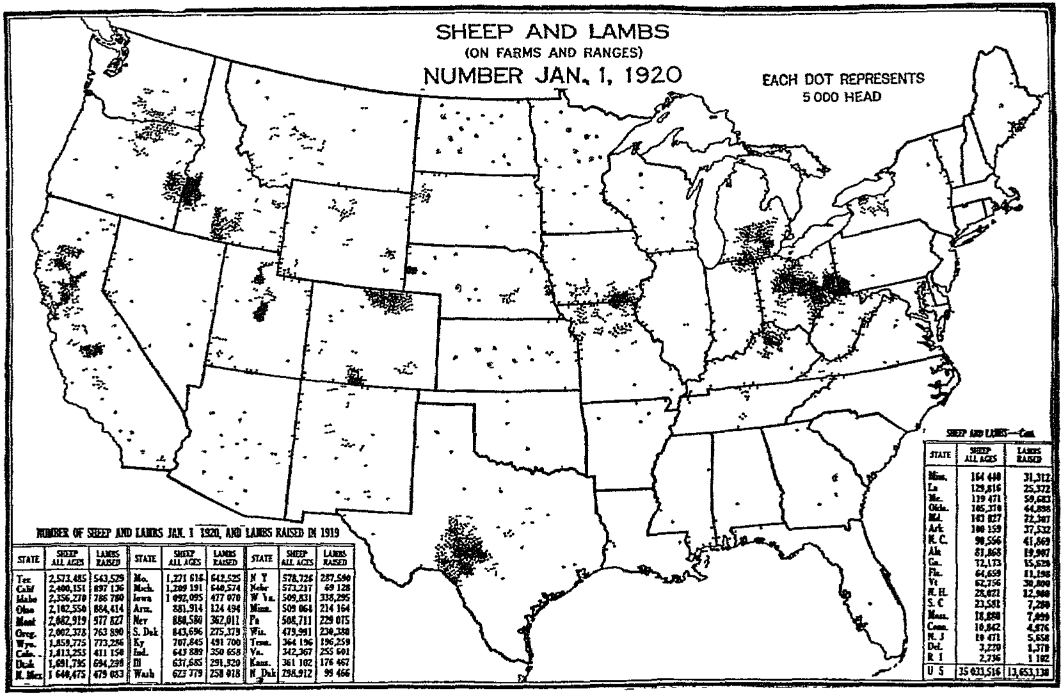
The large amount of labor involved in making butter is causing a rapid development of substitutes The best known is oleomargarine, a factory product, made largely from beef fat (margarine) and cotton seed oil Cocoanut oil, olive oil, cotton seed oil, peanut oil and other vegetable oils are also used as butter substitutes in the pure form or in various combinations with butter and margarine.

8 Sheep

Origin and importance of the sheep. It is generally thought that our ancestors found the sheep upon the mountains of central Asia, a mottled animal of black, white, and brown, whose pelt has made us the best of all protections against the cold and aided our advance into the land of frost and snow. History contains no record of the origin of cloth making, so remote was its beginning. For many ages before the coming of cheap cotton (about 1800) (see chapter on textiles), woolen cloth was the chief clothing material in the temperate zone, and sheep were much more universally kept than they now are.

Factors affecting the distribution of sheep industry. Before the beginning of the railway epoch, sheep were distributed upon the farms of Europe and America, and most countries were nearly self-supporting with regard to supplies of wool and mutton But the period of world settlement and world commerce following the railway and steamship about 1850 led to an entire revolution in the sheep and wool situation of the world. A sheep industry on the largest scale that has ever been or is ever likely to be seen, resulted from the throwing open of large areas of land in North and South America, Africa, Australia, and central Asia which could be best used as sheep ranges

Probably because of mountain ancestry, the sheep is a good climber for rough pastures, and a good traveler He can go far for his food and water, or to market He is well fitted for the utilization of land not fit for the plow, and regions with greatest dependence upon sheep are those parts of the earth's surface which for some reason are not available for cultivation. It may



NUMBER OF SHEEP AND LAMBS JAN. 1 1920, AND LAMBS RAISED IN 1919

STATE	SHEEP ALL AGES	LAMBS RAISED	STATE	SHEEP ALL AGES	LAMBS RAISED	STATE	SHEEP ALL AGES	LAMBS RAISED
Tex	2,573,485	543,529	Mo.	1,271 616	642,525	N Y	578,726	287,590
Calif	2,400,151	897 136	Mich.	1,209 191	640,574	Nebr	573,237	69 128
Idaho	2,356,270	786 780	Iowa	1 092,095	477 070	W Va.	509,831	338,295
Ohio	2,102,550	884,414	Ariz.	881,914	124 494	Minn.	509 064	214 164
Mont	2,082,919	977 827	Nev	880,580	362,011	Pa	508,711	229 075
Oreg.	2,002,378	763 890	S. Dak	843,696	275,379	Wis.	479,991	230,380
Wyo.	1,859,775	773,286	Ky	707,845	491 700	Tenn.	364 196	196,259
Colo.	1,813,255	411 158	Ind.	643 889	350 658	Va.	342,367	255 601
Utah	1,691,795	694,298	Ill	637,685	291,920	Kans.	361 102	176 467
N. Mex	1 640,475	479 083	Wash	623 779	258 018	N Dak	298,912	99 466

SHEEP AND LAMBS—Con.

STATE	SHEEP ALL AGES	LAMBS RAISED
Miss.	164 440	31,312
La	129,816	25,372
Me.	119 471	50,683
Okla.	105,370	44,898
Md.	103 027	22,307
Ark	100 159	37,532
N. C.	98,556	41,869
Ala	81,868	19,907
Ga.	72,173	15,628
Fla.	64,658	11,198
Vt	62,756	30,800
N. H.	28,021	12,900
S. C	23,581	7,280
Mass.	18,890	7,899
Conn.	10,842	4,576
N. J	10 471	5,658
Del.	3,220	1,378
R I	2,736	1 102
U S	35 033,516	13,653,138

FIG 64 —The absence of sheep from the warm moist southeast is noticeable (United States Dept Agr.)

be that the land is too rough and too wet, as in the Scotch Highlands with their heavy rains Semi-aridity, however, is the greatest reason why land is devoted to pasturage of sheep rather than to cultivation of grain and other crops.

Value of sheep to regions remote from markets. A third reason why land may be devoted to sheep is its inaccessibility for the marketing of the heavy and less valuable products of agriculture

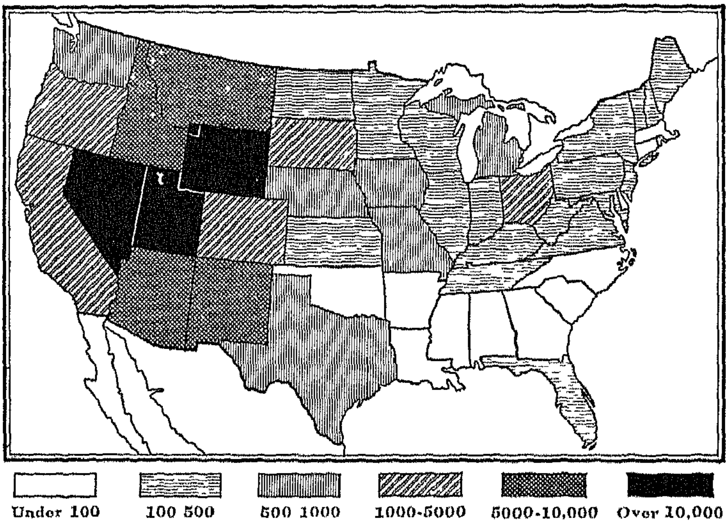


FIG. 65.—Sheep in the United States per 1000 rural inhabitants, by states, Jan 1, 1924. Population, 1920

in which transportation costs must be relatively high. Grain requires a railroad close at hand. Cattle, unless their meat can be marketed, have nothing to yield but the hide and tallow which is relatively of less value than the fleeces, skins, and tallow of sheep Consequently, sheep flocks give the people of remote plains the greatest possible cash income, and the opening of new lands between 1850 and 1890 caused an enormous increase in the number of sheep throughout the whole world.

Sheep have for several decades competed with cattle for the grass of the plains and mountains of the United States beyond the one hundredth meridian. Upon these western plains as upon

other great sheep-growing plains, there is a special method of caring for the sheep Owing to the defenseless character of these stupid animals they require constant care and may not be allowed to shift for themselves as cattle do The herder with a couple of dogs takes a flock of two or three thousand sheep and follows them for days and weeks, being met at appointed places

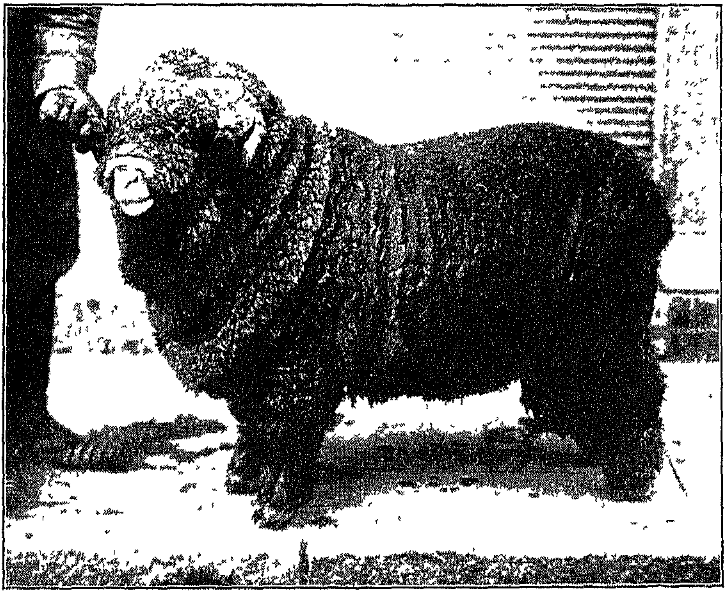


FIG 66 —By artificial selection for one quality some strains of Merino sheep have become racks for wrinkly skins, and every wrinkle covered with fine wool until the sheep is almost blinded by it

by supply wagons sent out by his employer. The sheep dogs, with the inherited qualities of many generations, are much more skillful helpers in driving them than men could be, and the herder's rifle protects from wolves, foxes, and dogs, while the flocks are commonly put into corrals or fenced enclosures at night It is common for the lambs from the range flocks of our western states to be shipped eastward like the range cattle to the corn belt in the autumn for fattening.

Sheep upon the farms of eastern United States. The older sheep regions, namely, the farms of eastern United States and Europe, which were the sole dependence for sheep before 1850, still support sheep, but only in small flocks grazing in fenced fields Because they receive the personal care of their owners

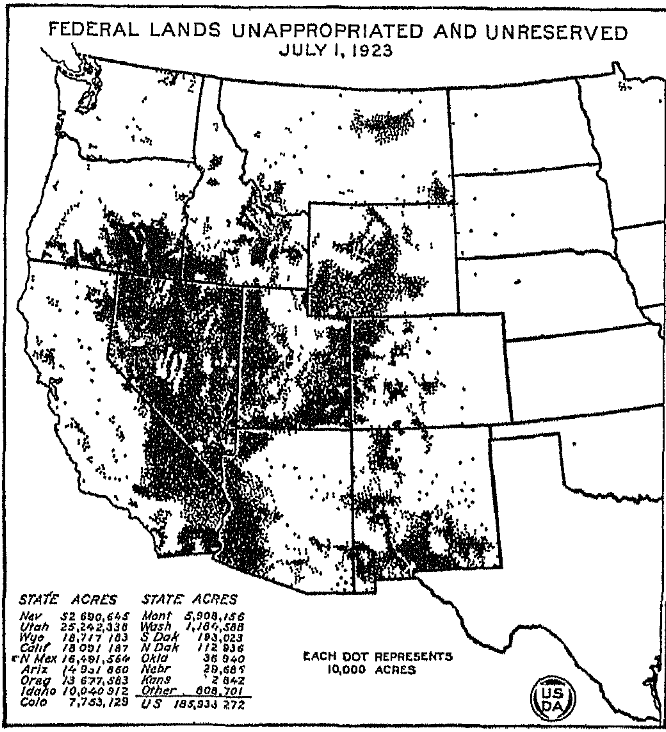


FIG. 67 —If we rule out the National forests of the states west of Texas we have here a map of the land on which agriculture is not now possible

such small flocks fare much better and produce a larger proportion of lambs than can be raised in the large flocks upon the range, where less attention is given them Many of the eastern sheep owners make a specialty of rearing their lambs in the winter season and sending them to market early in the year when they command a very high price.

There is a tendency for the sheep of the distant and arid West to be of the best wool-producing breeds (Fig 66) and for those of the eastern farms to be of the best mutton breeds. Why?

New England, with its rocky and little-used farms, offers one of the best places in the United States for the extension of sheep growing. The rocky lands produce grass, and there might be worked out a combination of hill pasture and valley-grown winter forage such as exists in the arid West with its irrigated valleys.

Were it not for the ravages of sheep-killing dogs, the United States would have many million more sheep than it now has, for we have much suitable land not fully used.

9 The American Horse Industry

Horses of the European breeds early made their escape from the Spanish settlements in Mexico and ran wild on the western plains and mountains for three centuries. Some of them still roam in remote locations. These half wild horses, usually called Indian ponies or cayuses, like the Texas longhorn cattle of Spanish origin, have now almost disappeared through admixture with the European breeds brought from the eastern states.

Distribution of the horse industry. One of the best-known centers of American horse production is the blue-grass region of central Kentucky, with the city of Lexington as its center. This plain of eight or ten thousand square miles is underlaid by beds of limestone which upon exposure to the air break up into a soil of great fertility and one in which blue grass grows to perfection. This is one of the best of pasture grasses, especially for horses, which may be called one of the chief money crops of this region. The industry here has had a sad decline because its specialty, driving horses, has been displaced by the automobile. The small area of the Kentucky blue-grass region causes it to be of far less total importance in horse production than is the corn belt.

Throughout the whole extent of the corn belt alongside the farms where some men are fattening pigs and others fattening cattle, still others have droves of colts usually of the heavy draft breeds originally brought from France, Scotland, or Belgium. When 4 or 5 years old, these horses are sent by carloads to the

eastern cities and to many agricultural districts in the East where the farmers find it more profitable to raise crops suited to nearby markets, and buy their horses because they can so easily come from afar.

The raising of a few colts as a supply crop and occasionally as a money crop is carried on in almost all parts of the United States It is of greater importance in the Piedmont section of northern Virginia than in any other district east of the Appalachians Excellent cavalry horses are produced here and the United States Government maintains a remount station at Fort Royal

The use of the automobile and the farm tractor has decreased the number of horses in this country from 23 to 20 million head in the last ten years However, the United States uses more horses than any other nation (Russia is second with 18 million), and it is unlikely that the horse will be displaced in world agriculture for many years to come

The distribution of the mule. While the use of horses has diminished, the number of mules has grown by nearly one-third in the last decade. The ability of the mule to stand more hardship and a more humid climate than the horse has made him the favorite in the tropics and the southern part of the United States. In Iowa, Illinois, and Indiana (in 1924) the mules comprised only one-tenth of the three and one-half millions of equine draft animals but more than half of the six millions in the nine cotton-belt states. The cotton area contains nearly three-fifths of the mules in the United States.

The American mule industry. The finest mules are grown in the horse belt of Kentucky and adjacent districts of Tennessee. Missouri is probably the greatest mule-producing region of the United States and under a single roof in St. Louis 5,000 mules are sometimes for sale. From this market, and from Kentucky and Tennessee, they are distributed over a very wide area in the United States and in foreign countries.

10. Poultry

The value of poultry. The poultry industry seems to attract far less attention than its importance merits. The production

of eggs and poultry in 1923, according to the United States Department of Agriculture, was worth over a billion dollars Before the war prices benefited manufacture at the expense of agriculture our poultry and eggs outvalued our pig iron. Only four crops, wheat, corn, hay, and cotton, are now more valuable.

The wide distribution of poultry. That the importance of the lowly hen is so little realized may be partly explained by the fact that poultry raising is a widely distributed industry, usually conducted on a small scale. We also fail to realize its importance because of the difficulty of securing statistics, the absence of large financial or speculative operations in connection with poultry and eggs, the small influence of legislation upon them (and vice versa), the small part they play in international trade Poultry keeping is none the less important and is undoubtedly the most universal form of animal industry in the United States and also in Europe, east Asia, and other foreign countries. The names of breeds attest their world-wide distribution—Peking and Muscovy ducks; Cochin, Brama, Leghorn, Hamburg, Minorca, Indian Game, Wyandotte, and Plymouth Rock chickens; Brabant geese.

The very large majority of the fowls in this country are found in comparatively small numbers, about 60 per farm, on a very large number of farms, where they gather much of their own subsistence, and receive little care except in winter. The consequence is that the eggs are produced at little cost. More than 5 million farms produce eggs annually valued at more than half a billion dollars. The development of this industry to an extent incredibly larger than it is at the present time is among the easy possibilities.

There has been a marked increase in the number of specialized poultry farms since 1900. One of the causes of this change is the work done by the mechanical incubator. It hatches the chicks on a very large scale, and is almost as successful as the small-scale operations of the hen, which is thereby left free to devote her whole time to the production of eggs.

Poultry is equally well fitted to be a by-product in extensive agriculture or a main product in intensive agriculture, with a strong tendency to be important where intensive agriculture prevails

Half of the poultry in the United States are in the corn belt and around its margin, where feed is cheap. There are two notable districts of poultry specialization Six counties in southeastern Pennsylvania had nearly 5 million poultry (4,000 to the square mile) in 1920, while Sonoma County, California (Petaluma, the poultry center) had 3 million poultry with sales of $12,000,000.

Poultry raising and especially egg production are easily increased with a little care and skillful handling The application of the laws of animal breeding and feeding causes large increase in the average egg output The average egg production from our 300,000,000 hens is about 80 per hen per year Test pens of fowls given special care have averaged 240. If the average could be brought to only half that figure it would be an increase of 150 to 200 million dollars per year

Owing to the high value of output in proportion to food, it should be emphasized that the distribution of the poultry industry depends more on man and less on the environment than any other of the animal industries thus far discussed.

QUESTIONS

1 What is the geographic explanation of the meat situation in Japan and the United States?

2. What is usually the first use that civilized man makes of an open plain?

3. Why does an American beef animal commonly live in two places?

4 Why would our irrigated land be of less value if it were all in one place?

5. Which has greater possibility of increased meat production, that part of the United States west of 100° longitude or south of 36° latitude? Give some reasons for your answer

6 What was the effect of the refrigerator car upon the location of slaughtering industry? Explain

7 Why is dairying more intensive than meat production?

8. What are the characteristics of a region that is devoted largely to sheep production?

9. Compare the value of the poultry, and gold-mining industries?

NOTE —Fishing industries have not yet been discussed.

CHAPTER III

THE VEGETABLE INDUSTRIES

Food value of vegetables. The cereals give us bread, the animals give us meat, but the foods we call vegetables give us substitutes for both, and are also invaluable in their own specialties The chief food element of the potato and the cereals is starch, one of the two most universal food elements of all mankind It is classed as a carbohydrate—energy food. It helps to make fat and heat to keep the body warm, and gives energy for work. Starch is the surplus nutrition stored within the plants for their own future needs or for their offspring Sometimes it is packed in the seeds, as in the grains, or in the roots, as in sweet potatoes, or in underground stems, as in the white potatoes, or even in the trunks of some of the trees, as in the sago palm The other great food element, proteid, the tissue or muscle maker (see table of food values, appendix) is furnished by milk, meat, cheese, eggs, most of the nuts, and the leguminous plants, of which peas and beans are the best and commonest examples In addition to these elements of nutrition the vegetables furnish us with mineral salts necessary for bones, teeth, and nerves, and acids that are valuable as regulators They also furnish us mysterious but potent things called vitamines, without which we die. Yet further they furnish us with bulk and roughage, without which our very long alimentary tract often fails to function properly.

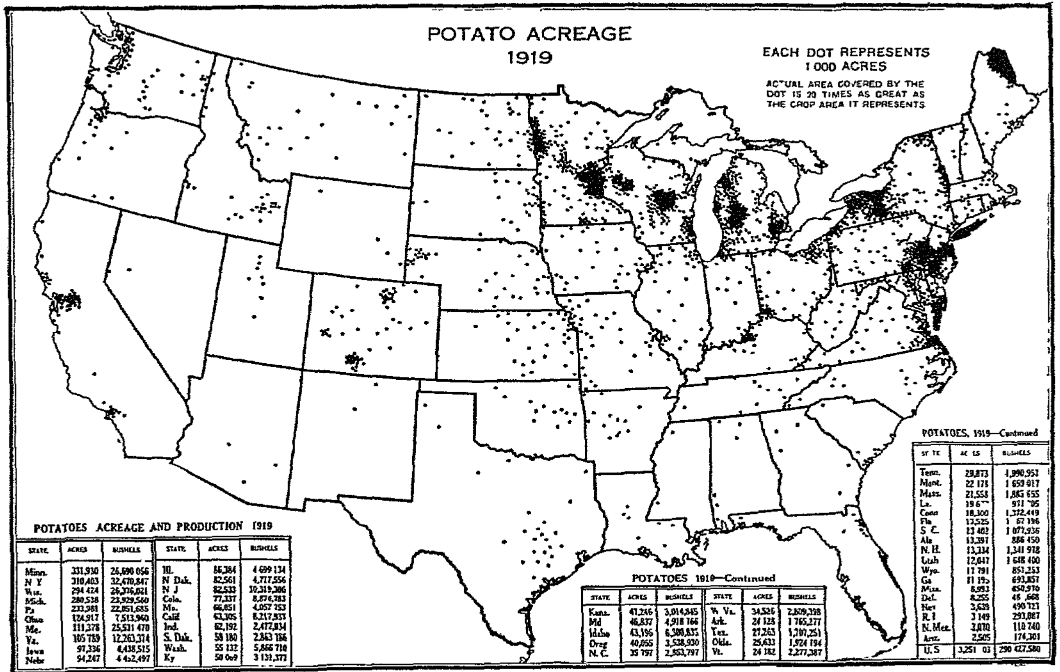
Location of vegetable industries. Vegetables form an important supply crop in every section of the United States, but only in certain localities are they a money crop. These localities are determined partly by conditions of soil and climate, and partly by proximity to markets On account of their bulk and their perishable nature, vegetables are largely consumed near the place of production. The desire for fresh vegetables is a strong impetus to commerce in them, and with the improvement of transportation there is a rapidly increasing commerce in fresh

vegetables For example, Britain alone imported 65 million dollars worth in 1920, and has in addition a lively local trade between her own warmer southwest and the interior cities

1 The Potato

Origin and use. The potato, second only to breadstuffs as a starch food, is probably exceeded only by bread in the number of times per year it is eaten by the average European or American The plant is a native of America, growing wild on Mexican and Andean plateaus, whence it was taken to Europe Introduced into Ireland in 1586 by Sir Walter Raleigh, it soon became important, and it has long since established itself as the great starch food in cool moist climates It is probably the plant most commonly grown in the vegetable gardens of Europe and America, but its growth as a money crop is quite restricted, offering in this respect a marked contrast to wheat. The potato and rice are rivals in supplying starch other than bread for the tables of Europe and America, but owing to differing climatic requirements the two plants are rarely rival claimants for the farmer's attention The recently discovered art of making potato flour has given the otherwise perishable tuber a new means of competing with rice, but this flour has not had time to gain very wide use outside of Germany where it was first manufactured, and proved of great use during the food scarcity brought on by the World War.

Climatic requirements of the potato. The potato is a crop of wide climatic range, because it can stand a cool climate and mature in a short season. Cold Alaska as far north as Fairbanks produces potatoes regularly (23,000 bushels from 250 acres in 1923), and it is cultivated as far south as the sub-tropics in Florida and Egypt. It also tolerates a variety of soils. It grows well on medium heavy land suitable also for wheat or corn, but tends to become important as a main starch food for people, and a money crop for farmers, in regions where it is too cool for corn to grow to the best advantage, or where the soil is too sandy and light for large yields of small grains It does not do well on heavy clay. The regions that best meet the potato conditions are northern and northeastern United States, Canada, and north



POTATOES ACREAGE AND PRODUCTION 1919

STATE	ACRES	BUSHELS	STATE	ACRES	BUSHELS
Minn.	331,930	26,690 056	Ill.	86,384	4 699 134
N Y	310,403	32,470,847	N Dak.	82,561	4,717,556
Wis.	294 424	26,376,021	N J	82,533	10,319,386
Mich.	280,538	23,929,560	Colo.	77,337	8,874,783
Pa	233,981	22,851,685	Mo.	66,851	4,057 253
Ohio	124,917	7,513,960	Calif	63,305	8,217,533
Me.	111,378	25,531 470	Ind.	62,192	2,472,834
Va.	105 789	12,263,374	S. Dak.	58 180	2,863 186
Iowa	97,336	4,438,515	Wash.	55 132	5,866 710
Nebr	94,267	4 452,497	Ky	50 0?9	3 131,373

POTATOES 1919—Continued

STATE	ACRES	BUSHELS	STATE	ACRES	BUSHELS
Kans.	47,246	3,014,845	W. Va.	34,526	2,809,398
Md	46,837	4,918 766	Ark.	24 123	1 765,277
Idaho	43,196	6,300,835	Tex.	27,263	1,707,251
Oreg	40,055	3,538,930	Okla.	25,633	1,924 194
N. C.	35 797	2,853,797	Vt.	24 182	2,277,387

POTATOES, 1919—Continued

STATE	ACRES	BUSHELS
Tenn.	29,873	1,990,953
Mont.	22 175	1 659 017
Mass.	21,553	1,845 655
La.	19 6[illegible]	971 [illegible]05
Conn	18,300	1,372,449
Fla	17,525	1 [illegible]67 196
S C.	13 402	1 077,936
Ala	13,397	886 450
N. H.	13,314	1,341 978
Utah	12,047	1 648 400
Wyo.	11 791	851,253
Ga	11 195	693,857
Miss.	8,993	650,970
Del.	8,255	45 ,668
Nev	3,639	490 721
R I	3 149	293,087
N. Mex.	3,070	110 740
Ariz.	2,505	174,301
U. S	3,251 03	290 427,580

FIG 68 —Compare this map with the corn map and note how heavy growth of corn and potatoes do not cross. (United States Dept Agr.)

Europe It does not thrive without irrigation in the dry summer of the Mediterranean type of climate which is also too hot except along cool seashores

The yield of potatoes. The bulky tuber yields six times as many bushels per acre as does wheat, and does it in less time Therefore it is of great value in enabling land to support dense populations, although a bushel of potatoes is not so nutritious as a bushel of grain (see table of food values, appendix) A 10-year average yield per acre in the United States is for wheat, 14 4 bushels, corn, 27 bushels, potatoes, 97 bushels Owing to the laborious method of preparing the seed, the expensive fertilizers necessary, the continuous cultivation, and protection from insects and blights by spraying, the potato crop requires more labor than any of the grains Hence potato fields are smaller than grain fields, and the crop is well fitted to intensive agriculture where a small area must, by much labor, be made to yield a large product, such as is necessary in countries of dense populations (Fig 69) Thus the average acre yield in Germany is more than double the yield in America, but some sections of the United States make as good an average as does Germany The potato harvest, toward the end of summer, leaves the ground in excellent condition for a fine crop of winter grain which usually follows it.

Distribution of the potato industry. Owing to the average American's ability to raise corn or to buy higher priced foods, the potato is grown less in America than it is in Europe. The chief centers of its growth lie north and east of the corn belt (Fig. 68). It is grown to a great extent as a money crop in certain sandy areas in Wisconsin, Minnesota, Michigan, and also in parts of Pennsylvania, New York, and New England, especially Maine. In the adjacent and similar parts of Canada it is of even greater relative importance

Our 6,700 square miles in potato fields are but a tiny patch in comparison to our area. A large crop gluts the market, and actual overproduction or the fear of overproduction and the consequent low price is the limiting factor in potato production.

Possibilities of extension of the potato industry. The price to the grower fluctuates between five cents and 4 dollars a bushel, between absolute loss and large profits. The existing farms and

interfering with other crops. If we could sell a surplus of 40 million or 400 million bushels of potatoes in the form of flour, cow feed, starch, and alcohol, as in the case in Germany, it would be a boon to American agriculture. Agricultural overproduction is a fact of unappreciated importance in checking the production of perishable commodities of which the potato is an example.

The potato in commerce. The supply of early potatoes for northern markets from southern lands gives rise to an important

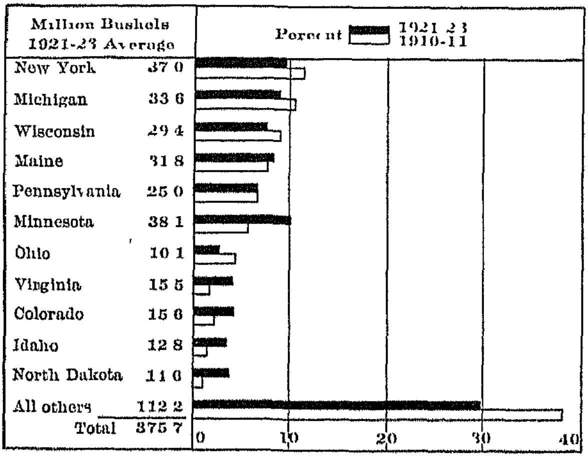


FIG. 70.—United States potato production, three-year average.

commerce in many parts of the world, which is really a part of the trade in vegetables. Thus, Algeria derives a large income from potatoes which reach Paris in thirty-five to forty hours. Egypt sends the first potatoes of the season across the Mediterranean to northwest Europe, and Bermuda ships Christmas potatoes to New York.

On account of the great bulk and weight of potatoes in proportion to value, and because of their perishable nature, they are much less important in foreign trade than in domestic production. As a whole, they have a tendency to become a national supply crop, with commerce limited to emergencies and early supplies. When, as occasionally happens, we have a shortage

in this country, they come to us by millions of bushels from Canada, Ireland, Scotland, Germany, and Egypt We have a small export of potatoes to Caribbean lands where the warm climate makes their growth unsatisfactory.

The sweet potato supplies the same need in human diet, and differs from the white potato only in the greater amount of sugar and nourishment that it contains (see table of food values, ap-

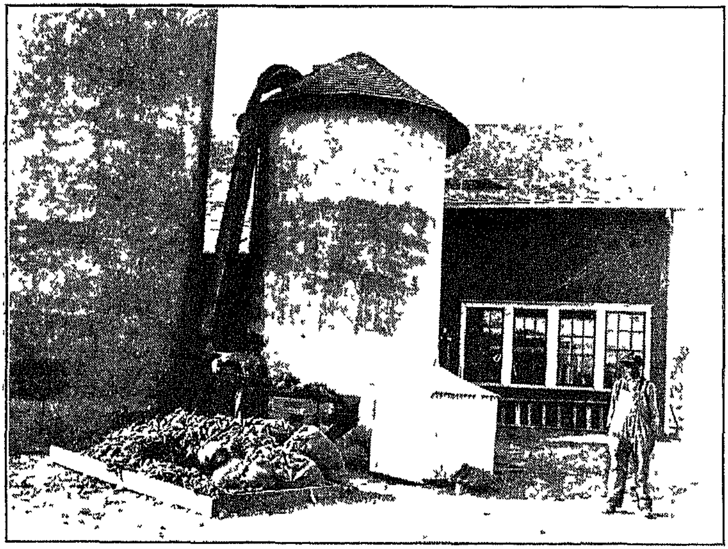


FIG 71 —The concrete silo in a southern state being filled with sweet potatoes is suggestive of great possible expansion of the dairy industry

pendix) The sweet potato is a perennial where there is no frost, yet it will grow a crop in the warm summer as far north as Iowa or New York, and is a crop of considerable importance in American agriculture Fortunately the sweet potato requires even lighter and sandier soil than the white potato and is, therefore, much grown on the sandy lands of the coastal plain in New Jersey, Maryland, and Virginia, where it is largely produced for shipment to the northern states Similar sandy spots in Iowa and other north-central states render similar service for the interior of the United States and western Canada. This crop is

also very widely grown throughout the southern states as a local food supply, where the people have the alternative of rice or sweet potatoes as their chief starch food in addition to corn or wheat bread. A temperature of 45° F. starts the sweet potato toward decay, a fact that checks it in commerce. If the demand should arise the southern states could produce millions of tons of dehydrated sweet potatoes or sweet potato flour.

2. Other Vegetable Industries

Garden vegetables. Nearly every farm has a vegetable garden. Owing to the large yield of a small plot of ground under

Fig. 72.—This Florida tomato field yielding its winter harvest is a type of use that might be increased many fold if wanted.

intensive care, such gardens are very common in villages and small towns of both Europe and America. Aided by the food and income from this source, the retired farmer of America is able to be well fed in country towns on surprisingly small cash income from other sources.

In the European and American gardens are to be found a large variety of plants that represent in their origin every continent and almost every country in the world. In many cases they have been cultivated until they bear little resemblance to

their original form, and in our list of vegetables is found in edible form every part of a plant—roots, stems, leaf stalks, leaves, blossoms, pods, seeds

The nitrogen-producing legumes or pulse. The most important (save possibly cabbage) of all the plants commonly called vegetables is the group of legumes called pulse in the Old World, comprising the many kinds of peas and beans These differ from all other vegetables in the large amount of proteids or nitrogenous food, meat substitutes, which they contain (see table of food analysis, appendix) Nitrogen, as food for man, beast, or plant, is expensive to buy in spite of the fact that three-fourths of the air is nitrogen. Owing to its chemical inertness, nitrogen is hard to obtain in available forms The legumes have upon their roots nodules (Fig 73) which are colonies of the microscopic plants called bacteria These organisms catch nitrogen freely from the air and make it available for plant food and thus the legumes by means of the bacteria on their roots render mankind a service of incalculable value by giving nitrogenous food for man, beast, or plant By the aid of these bacteria, the legumes can grow in poor soil and leave it the richer in nitrogen because of the nodules on the roots that remain in the ground (Fig 74) This fact recently discovered is one of the greatest agencies for the future enrichment of the race through the restoration of worn-out soils

The pulse plants, represented chiefly by peas in northern climates and beans in southern climates, are less widely used in the United States than in any other populous country. This is because our people can afford the expensive nitrogenous foods, meat, cheese, and milk, of which group of foods we use more per person than any other large group of civilized people.

The trade in vegetables. The trucking industry is located partly in reference to nearby population centers, partly where climate (and to a lesser extent soil) are advantageous Fifty years ago each town and city depended upon its immediate locality for vegetables, and most cities still have and will continue to have nearby farms where truckers grow all the garden crops in season In addition, an ever-increasing number of markets now have a supply of green beans, lettuce, tomatoes, and other vegetables every week in the year. Some are produced in nearby

hothouses, but most of them are grown in warmer regions farther south and brought by the refrigerator car, fast freight, and the coasting steamer This trade is of very recent origin and is increasing rapidly It could not come until rapid transportation

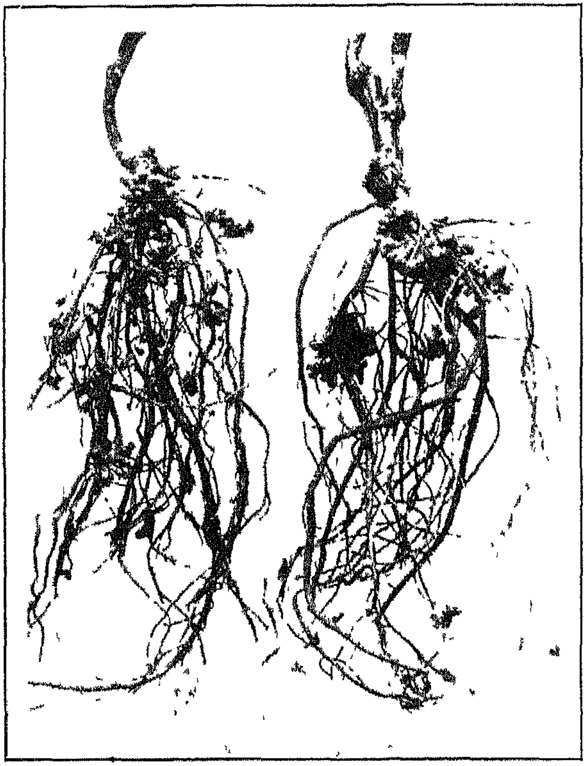


Fig. 73 —The roots of the sweet pea, one of the legumes, with the nodules made by the nitrogen-gathering bacteria

and refrigeration made possible the handling of perishable commodities. In emancipating the city from dependence on local fields these improved transportation facilities have caused the development of an enormous trucking industry in rather concentrated areas throughout the entire length of the Atlantic Plain

FIG. 74.—Two alfalfa plants treated alike in every respect except that the larger one had nodules on its roots to supply it with nitrogen while the smaller had none.

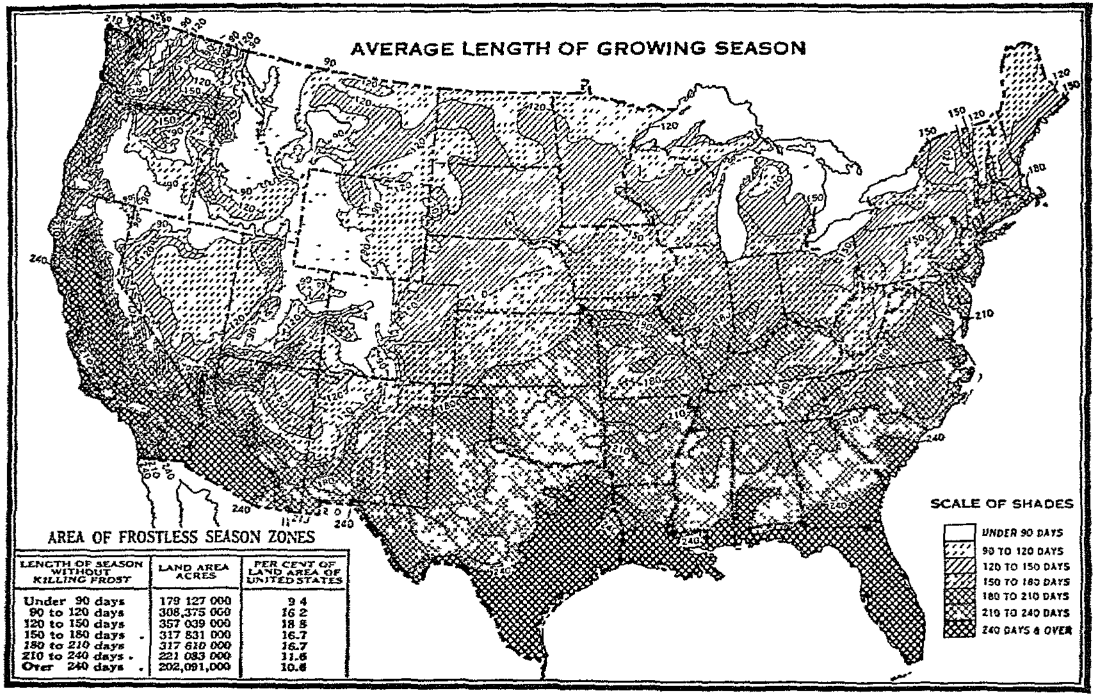


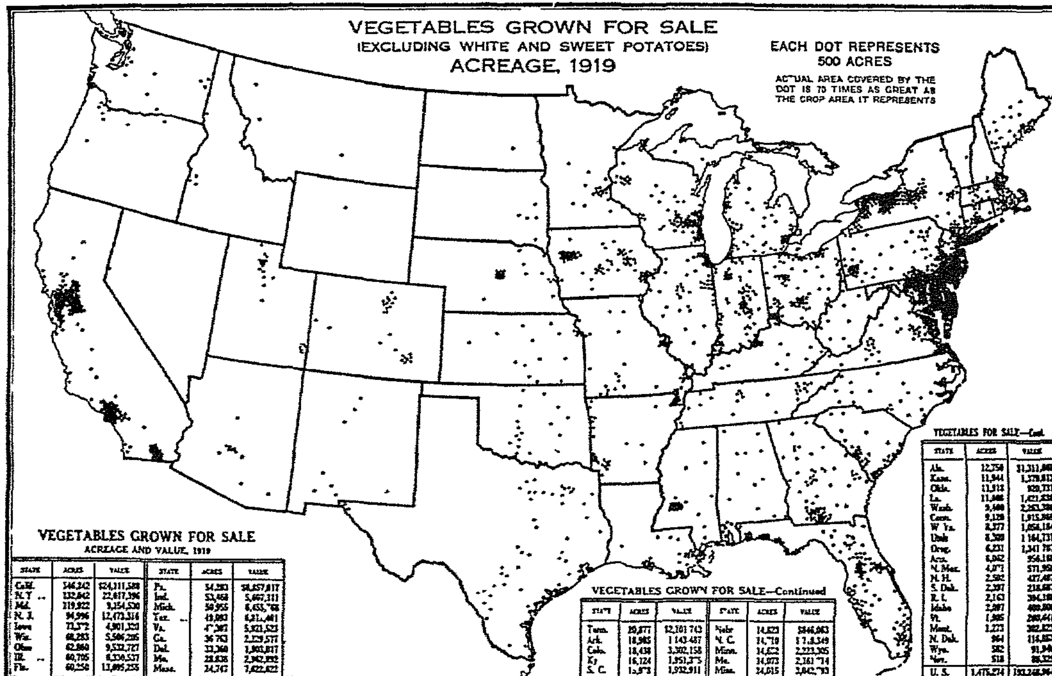
FIG. 75.—This is an interesting map of agricultural possibilities. (United States Dept Agr)

from the east end of Long Island to the tip of Florida and on beyond into Cuba.

Vegetable production on the Atlantic Plain. The Atlantic Plain is a nearly level area lying between the Atlantic Ocean and the first stratum of hard rock that limits the sands and clays of the plain and causes, in the rivers crossing it, a series of waterfalls extending in a nearly straight line from New York southwestward through the cities of Trenton, Philadelphia, Baltimore, Washington, Richmond, Raleigh, N C, and Columbia, S C The sandy soil of this plain suffices for the growth of excellent peas, melons, cabbages, strawberries, etc, which are composed chiefly of water The Atlantic Plain has an advantage of time even over the Piedmont and Appalachian districts lying to the west, with their fertile but heavy clays, because the sandy soil being drier can be cultivated earlier in the spring, and it also brings plants to maturity more quickly than the damper rockier clay

From this plain there comes throughout the cooler part of the year a procession of vegetable products that follows the advance of the seasons (Fig. 75) When October turns the fields of New Jersey and Long Island brown, the huckster and the groceryman of the northern cities begin to sell beans, lettuce, eggplants, and cucumbers shipped from southern locations As the spring advances northward, so does the location of the truck harvest, which includes potatoes and all kinds of vegetables South Florida begins shipping in December Next come the supplies from central and northern Florida, then from the district about Savannah, Ga, then the Charleston, S C, district, including the nearby islands, has its turn, followed by New Berne and Wilmington in eastern North Carolina Next comes Norfolk, Va, one of the greatest trucking centers in the United States, with steamboats running to Washington, Baltimore, Philadelphia, New York, and Boston This port ships enormous quantities of early potatoes and strawberries to the northern cities, to be followed in its turn by the peninsula known as the "Eastern Shore" between the Chesapeake Bay and the sea.

The bulky nature of products of this class gives a great advantage to the producer who can haul the crop to market in his own wagon or motor truck Hence there is a great concen-



VEGETABLES GROWN FOR SALE

ACREAGE AND VALUE, 1919

STATE	ACRES	VALUE	STATE	ACRES	VALUE
Calif.	346,242	$24,311,588	Pa.	54,283	$8,857,817
N. Y.	132,642	22,617,396	Ind.	53,468	5,667,311
Md.	119,922	9,354,530	Mich.	50,955	6,655,768
N. J.	94,996	12,473,316	Tex.	49,083	4,211,461
Iowa	73,572	4,901,320	Va.	47,383	5,321,523
Wis.	68,283	5,506,205	Ga.	36,763	2,229,577
Ohio	62,860	9,532,727	Del.	33,360	1,803,817
Ill.	60,705	8,330,537	Mo.	28,836	2,962,892
Fla.	60,256	13,895,255	Mass.	24,347	7,422,822

VEGETABLES GROWN FOR SALE—Continued

STATE	ACRES	VALUE	STATE	ACRES	VALUE
Tenn.	20,877	$2,101,743	Nebr.	14,823	$846,083
Ark.	18,985	1,143,487	N. C.	14,718	1,718,349
Colo.	18,438	3,302,158	Minn.	14,622	2,223,305
Ky.	16,124	1,951,375	Me.	14,073	2,161,714
S. C.	15,573	1,932,911	Miss.	14,015	3,042,793

VEGETABLES FOR SALE—Cont.

STATE	ACRES	VALUE
Ala.	12,758	$1,311,868
Kans.	11,944	1,378,812
Okla.	11,918	920,731
La.	11,446	1,421,838
Wash.	9,400	2,253,308
Conn.	9,128	1,915,868
W. Va.	8,377	1,054,184
Utah	8,300	1,164,731
Oreg.	6,231	1,341,787
Ariz.	6,042	954,188
N. Mex.	4,073	571,958
N. H.	2,582	427,483
S. Dak.	2,397	218,687
R. I.	2,163	394,188
Idaho	2,087	488,808
Vt.	1,385	288,443
Mont.	1,223	382,823
N. Dak.	964	114,883
Wyo.	582	91,948
Nev.	518	86,325
U. S.	1,475,274	193,248,964

FIG 76—This map shows city centers and special soils To check the exaggerations of scale see actual figures in the tables (United States Dept Agr)

tration of production near the larger cities, especially within a 30-mile radius of Philadelphia, where good land for truck is within easy reach of city market

The areas draining into the Gulf of Mexico have a similar but less extensive truck industry for the cities lying to the north of them Chicago and other cities in the central states draw their off-season supplies partly from certain sandy districts in Tennessee, Alabama, Mississippi, northeastern Texas, and in southern Texas on the Gulf plain, near the mouth of the Rio Grande

The California vegetable industry. The open winter of California gives that state an important vegetable industry which probably reaches its highest development on the reclaimed delta lands ("tules") at the mouths of the San Joaquin and Sacramento Rivers These deltas are especially fine for the production of asparagus, which is grown in vast fields Some of it is shipped to the Atlantic states while fresh, but most of it is canned[1] The California truckers produced 44,000 carloads of vegetables in 1921 and despite the great drawback of long distance and high freight rates many thousands of carloads went to the eastern markets Transportation is less of a deterrent on the dried beans, concentrated and non-perishable, which are grown and prepared in great quantities ($18,000,000 in 1922) on the semi-arid lands near the sea in southern California

QUESTIONS

1 Name the two great food elements, their uses, and two sources from which each is obtained

2 Is the potato a better crop than wheat for intensive agriculture and dense populations?

3 Do we grow potatoes on all the land suited to them? What would happen to the industry if we grew them on half the potato land?

4 Why does the potato price fluctuate less in Germany than in the United States?

5 How do the bacteria upon the roots of legumes enable us to use less meat?

6 What characteristic of the soil of the Atlantic coast plain adapts it to vegetable growing? Is it all so used? Why?

7 How does a climatic factor scatter the vegetable industry over the country?

[1] For the influence of canning on the vegetable industry, see latter part of next chapter

CHAPTER IV

THE FRUIT AND CANNING INDUSTRIES

The standard fruits grown in the United States are not so nutritious as many of those grown in the Old World The date, the fig, and the olive, so important in countries on the Mediterranean, are far more nutritious than the apple, the orange, and the peach, the leading fruits of the United States Despite their low nutrition, the production of fruits is an extensive industry and one of especial interest to the student of geography because of the very great influence of the geographic environment upon it.

1. The Grape

Origin of American varieties. When the European colonists landed upon the shores of the United States and stocked their gardens with the plants and trees of Europe, the grapevines promptly died from a mysterious blight that destroyed the leaves. This was due to fungi which thrive in the heat and humidity of the eastern American climate, but which the vines had never been subjected to in cool west Europe or the dry summer of south Europe Yet the colonists found in the American forests wild grapevines climbing to the tops of tall trees and growing to enormous size, their stems often reaching a thickness of half a foot or more. From this stock the people of the eastern part of the United States have in three centuries evolved a number of varieties of edible grapes, much more tasty to many people than those of Europe, their names, Concord, Niagara, Early Ohio, etc., showing their American origin.

Location of the American grape industry. There are now two widely separated centers of commercial grape growing in the United States· the eastern, near the Lakes, growing American varieties; and the western, in California, growing European varieties. The eastern grape belt lies close to the shores of Lake Erie, Lake Ontario, and the five slender north and south lakes of central New York, called the Finger Lakes. The vineyards

of the Finger Lake district are upon the southern and western slopes of the hills along the eastern shores of the lakes, the prevalent west winds blowing across the waters in spring, giving the cool temperature necessary to retard the growth of the vines in the spring until the danger from frost is past Along the southeastern shore of Lake Erie, especially on certain islands in the lake, and even on the Canadian shore, the vineyard is much the most important field upon the farm and is often the entire dependence of the grower This eastern region produces table grapes which are far sweeter and cheaper, than are the edible grapes of central Europe

California, with her Mediterranean climate, has become a second Mediterranean country in other respects than as a producer of citrus and dried fruits. The climate has attracted colonies of Italian and Swiss vine growers who grow the European grapes which thrive in this part of America Over 300,000 acres of land, mostly centering at Fresno in the Great Valley, are devoted to grapes. This land is comparatively level, in marked contrast with the vineyards of Italy and Switzerland Its deep soil gives a greater yield per acre than that of any other region in the world.

2. The Citrus Fruits

The citrus fruits, including the orange, lemon, lime, grapefruit or pomelo, and several others of small commercial importance, are the advance guard of the tropic fruit supply These fruits can be transported to the markets of the north temperate zone because of the tough, thick, oily, and bitter skin which serves as an effective protection against insects, bruises, and decay A host of other delicious tropic fruits remain practically unknown to commerce because they lack such natural protection, but quick transportation and modern methods of refrigeration are rapidly extending their use. It is very suggestive that, before the World War, Germany successfully imported from Kamerun, in Equatorial Africa, fresh pineapples packed in peat dust, and that the alligator pear and mango of the West Indies are beginning to appear in our seaboard cities.

The orange, a native of southern Asia, grows throughout the tropics and on the sub-tropic edges of both temperate zones,

and is everywhere much prized as an article of food Like many other fruits it attains its finest quality near the colder limit of its production, so that the orange of the United States is superior to that of the West Indies It is to be had at almost all seasons of the year, since the orange tree carries ripe fruit and green fruit at the same time that it is in blossom Its wide distribution makes possible an almost unlimited production, but inasmuch as the fruit is quite bulky and its commercial handling expensive, it, like the banana, can enter into commerce in large quantities only where transportation facilities are of the best Consequently, the world's commercial supply is from a few localities readily accessible to the world's great markets. It is possible that more oranges waste beneath the tropic orange trees than are eaten by the people of many northern nations

About 1835 our sailing vessels first began to bring us oranges from Italy and Sicily, and later from the West Indies, but the abundant home supply has now about stopped the import Between 1880 and 1890, when through railroads were built to the South, it was discovered that Florida could ship oranges to northern states as well as grow them for her own use as had been the case for 300 years. The product of this southern region is excellent, but the orange growers have had much trouble with the occasional cold waves coming from the center of the continent and bringing freezing temperatures to the Gulf shore and to all of the Florida mainland If not in rapid growth at the time, the orange tree can resist some frost, but the moisture of the Gulf climate may make the tree grow rapidly at any time during the winter. Thus on January 1, 1894, a single cold morning altered the prospects of the state by killing practically all the orange trees in the northern part of the peninsula and bankrupting many of the growers. The bulk of the industry moved farther south and despite occasional injury to crop and sometimes to trees, there has been no other such destruction as that of 1894. Many growers now protect their crops by burning oil or charcoal in the orchards when frost threatens, and the growing of citrus fruits is again extensive.

Florida's misfortune in 1894 proved to be California's advantage. The northern limit of the orange in Florida is about 30° north latitude, while in California, owing to the oceanic climate

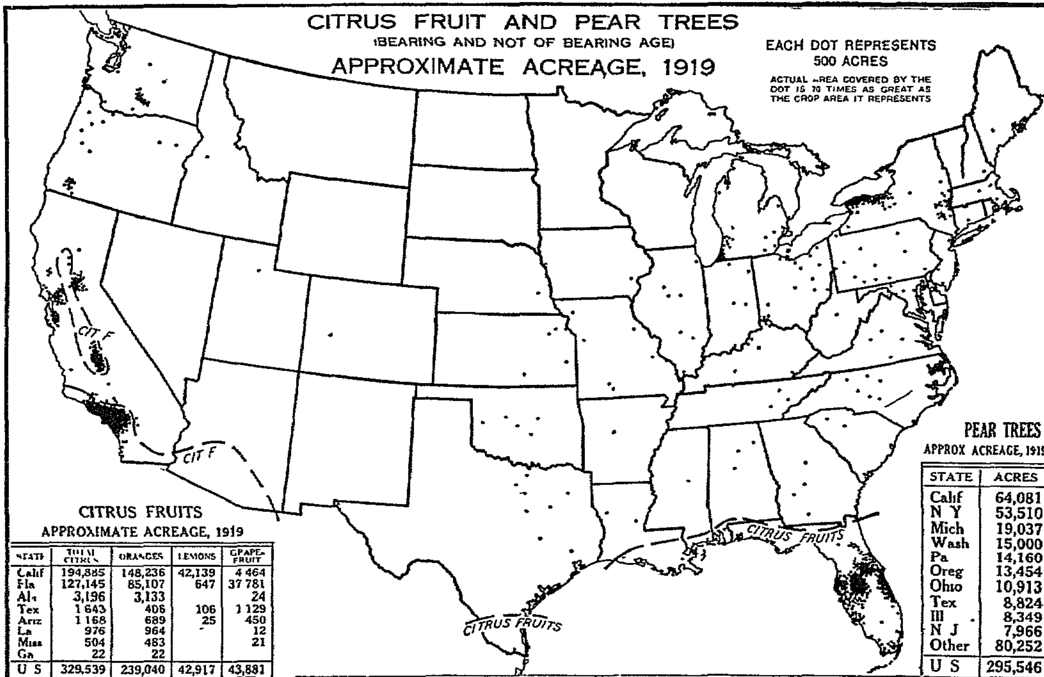


FIG 77 —The commercial growing of citrus fruits in the United States is practically confined to California and Florida In addition to oranges which are produced by both, California specializes in lemons, and the grapefruit (pomelo) is grown largely in Florida

Commercial pear growing is most important in California and New York (United States Dept Agr.)

of the Pacific Coast, the tree grows as far north as 40° in the northern part of the Great Valley. However, the region in which the industry has had its largest development is south and west of the coast range in the Los Angeles-San Diego district of southern California. Here the cold wave of the Mississippi Valley type is almost unknown and the danger of a destructive freeze is smaller than in Florida, although frosts that destroy the crop and injure the trees are not uncommon in many localities. The astonishing freeze in the California citrus fruit belt in January,

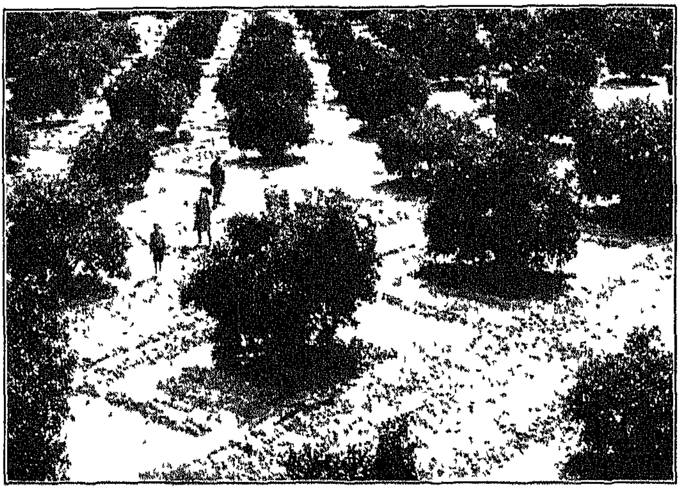


FIG. 78.—Irrigation of Arizona citrus fruit by the basin method, economical of water. (United States Reclamation Service.)

1913, had not been duplicated in 40 years, and cost the growers from $20,000,000 to $40,000,000.

California oranges are grown with the most perfect care on irrigated land of high value, the orchards often being valued at $2,000 and more per acre. This very high value is due not to scarcity of land, but to scarcity of water, which amounts to scarcity of land, since unirrigated California lands cannot grow oranges. Great pains are taken to get and save water for the irrigation of the California fruit orchards. Tunnels are sometimes dug back in the hillsides to strike the underground flow;

wells are dug and pumps lift the water sometimes more than a hundred feet to the orchards where it is often carried in pipes and put around the base of each tree so that the smallest possible amount may make an acre productive (Fig. 78) The great distance from the eastern market has made transportation costs high, so that only the best fruit can be shipped To attend to these matters the fruit growers have formed associations which are good examples of cooperative enterprise The

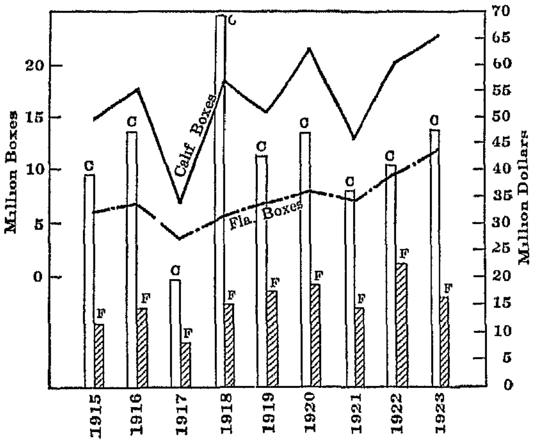


FIG 79 —The commercial orange crop in California and Florida

associations handle nearly all the California fruit distributed throughout the East, now about 50,000 carloads annually

Lemons and grapefruit. These fruits are less hardy than the golden orange. In the southern part of the California citrus district the lemon is now being extensively grown for the American market, but our import of about $2,000,000 worth per year, almost entirely from Sicily, shows that the home supply is still under the demand The California citrus orchards, covering over 200,000 acres, are about one-fifth lemons.

The pomelo, better known as the grapefruit of our breakfast table, is grown chiefly in Florida It has been known for many years, but its rise to popular favor has all come in the past fifteen years—a striking example of the possibility of developing the

public taste for other now unknown fruits The grapefruit production of Florida has increased from less than 25,000 boxes in 1901 to about 8,000,000 boxes in the season of 1923–24

The future supply of citrus fruits. California is using for citrus fruit only a fraction of her suitable land The total area planted is a little over 300 square miles, one-fifth of 1 per cent of the area of California Florida, with less than 7 per cent of her area in cultivation, with only eighteen persons to the square

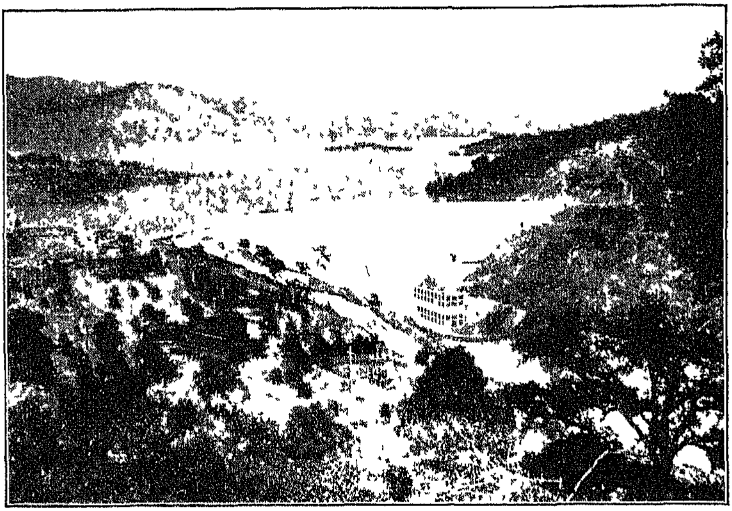


FIG 80—Dom Pedro dam in the Sierra Nevadas This storage reservoir with power plant at its foot waters thousands of acres of California fruit orchards

mile, an abundant rainfall, and about half of her area in reclaimable swamp of great fertility, has a much higher ratio of possible expansion than has California We could thus easily expand our orange and grapefruit crops by many, many fold

Citrus production has increased during the past 18 years at a rate nearly 6 times as rapid as our population increase. This expanding production has so far been met by a constantly increasing demand for oranges and grapefruit Planting is still going on rapidly. Manifestly the limit of orange production in the

United States is to be set, not by resources, but by prices Unchecked production in Florida and California can easily produce the same low price that prevails in the tropics where oranges lie unused on the ground

3 The Date, the Fig, and the Olive

The date, the fig, and the olive have been found to grow well in southwestern United States (Fig 81), where the climatic con-

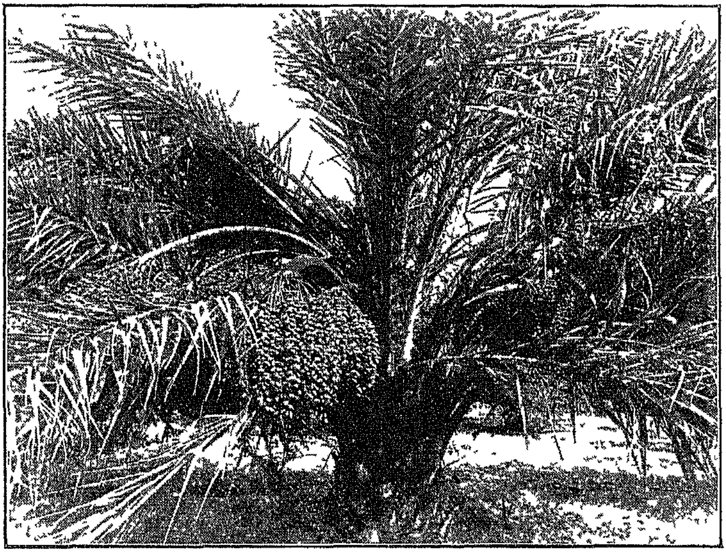


Fig 81 —Eight-year-old seedling date palm with phenomenal yield of 400 pounds fruit Phœnix, Ariz The trunk gets longer each year until it becomes a tall tree (Photo W T Swingle, United States Dept Agr)

ditions resemble those of their old home in western Asia, southern Europe, and North Africa. Their culture has now passed the experimental stage in the United States, and the results are very promising It is now a matter of economics Will it pay better to grow these crops or import them? The success of date-culture in both California and Arizona indicates that our imports of these Old World dry-land fruits may in time entirely cease,

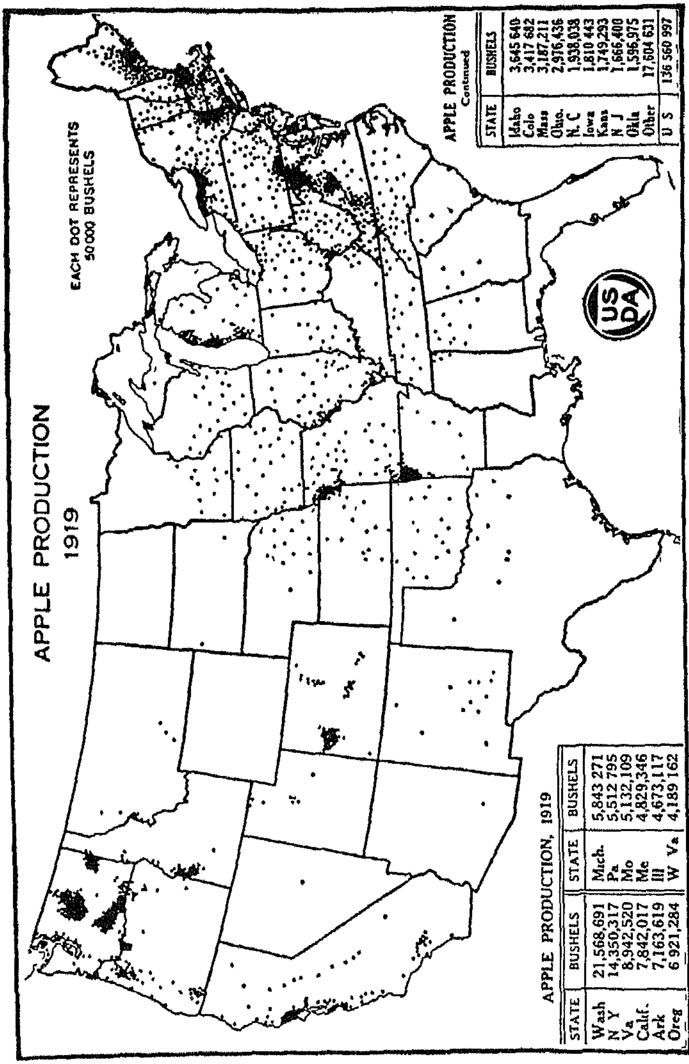
for we have abundant land to supply all our needs. The Imperial Valley near the mouth of the Colorado River and the Salt River Valley, have an abundant supply of water, a climate almost identical with that of the best date oases of the northern Sahara, and an area perhaps as great as the combined area of most of the oases of that desert outside of Egypt California figs are also being sent to the eastern markets

The long failure and final success of fig growing in California depended on the study of an insect For many years the fig trees had grown well but bore no fruit because of the absence of a certain insect that lives in Mediterranean lands. This insect crawls into the hollow cavity of the fig and fertilizes the many blossoms therein contained The establishment of fig growing in California waited for the successful acclimatization of the insect This was finally accomplished after much difficulty and many expensive attempts

California, Arizona and perhaps Texas, New Mexico, and Mexico have large areas of good olive land. There are many good olive orchards in California, but the price of olive oil makes it cheaper to import it than to grow it. This limits olive production in the United States to the small amount used in other ways.

4. The Apple

The apple is the fruit most extensively grown in the United States. The tree is the longest lived and, excepting the cherry, the largest of all our common fruit trees. It is hardy and is adapted to a wider range of conditions than any other important fruit tree. A large tree will often produce ten to twenty barrels of fruit in a single season From New England to North Carolina it is not uncommon to find trees healthy and bearing at the age of 100 years. The tree will grow well in practically all parts of the United States except the extreme South and the region between Lake Superior and the Rocky Mountains. Experiments give reason to believe that selection, breeding and new methods of cultivation will give satisfactory apple trees for this latter location, at least for the home orchard. Commercial production is carried on in districts where the climate is especially favorable and where industrial pioneers have proved the success of orcharding.



APPLE PRODUCTION, 1919

STATE	BUSHELS	STATE	BUSHELS
Wash	21,568,691	Mich.	5,843 271
N Y	14,350,317	Pa	5,512 795
Va	8,942,520	Mo	5,132,109
Calif.	7,842,017	Me	4,829,346
Ark	7,163,619	Ill	4,673,117
Oreg	6 921,284	W Va	4,189 162

APPLE PRODUCTION
Continued

STATE	BUSHELS
Idaho	3,645 640
Colo	3,417 682
Mass	3,187,211
Ohio	2,916,436
N. C	1,938,038
Iowa	1,810 443
Kans	1,749,293
N J	1,666,400
Okla	1,596,975
Other	17,604 631
U S	136 560 997

FIG 82 —Commercial apple growing in the East is most important along Lake Ontario, the Hudson River Valley, the Great Valley, and the Blue Ridge. The Michigan and the Ozarks apple belts lead in the middle West In the far West the irrigated valleys of Washington produce the largest crop, followed by California and Oregon.

New York is the leading state in commercial apple growing with Washington as a threatening rival Four counties on the shore of Lake Ontario in western New York have for a number of years been the most important apple-shipping district in the United States The Erie Canal and the railroads that followed it gave this region an early advantage in transportation to eastern markets This same waterway aided western competition, and made unprofitable the former staple products of New York farms, grain and live stock In addition to this disadvantage for growing staples, and the advantage for apple transport, this region has also a climatic advantage for the production of apples The large bodies of water with their melting ice in spring tend to delay the blossoming time until the danger of injury from frost has passed In autumn, the warm waters of the Lakes delay the killing frost. Although apples are the chief money crop of this district, there is no county in which the orchards cover a tenth of the land surface, a fact tending to show how rarely a locality depends upon a single crop

The lower peninsula of Michigan is important in the production of apples for reasons very similar to those prevailing in western New York The great development of apple orchards along the eastern shore of Lake Michigan and their striking absence on the west side, serves to emphasize the combined influence of the lake and the prevailing westerly winds.

Virginia has two apple districts with probably quite as large a proportion of the land planted in apples as is to be found anywhere east of the Rocky Mountains The first is in the Great Valley of Virginia and West Virginia not far from the cities of Winchester and Martinsburg Here upon a low ridge, called Apple Pie Ridge, an enthusiast some 60 years ago planted a large field in apples which eventually brought him many thousands of dollars Seeing his success his neighbors, after laughing at him for a while, also planted apple trees, until now the ridge for 25 miles is almost an unbroken succession of apple orchards, and they have since been extended to the ridges west of the Great Valley and to lands upon the valley floor

The second apple district of Virginia lies along the eastern slope of and east of the Blue Ridge Mountains in the central part of the state From this district large quantities of finely flavored

varieties are annually exported to England. Neither of these Virginia apple districts has any known advantage either in production or transportation over much other territory in the United States except for the accident of an early start The same thing may be said of nearly all American fruit localities despite much local belief to the contrary.

The open Mississippi Valley and the Ozark plateau. On the southern edge of the corn belt in Illinois, northern Missouri, Iowa, and Kansas extensive apple orchards have been planted,

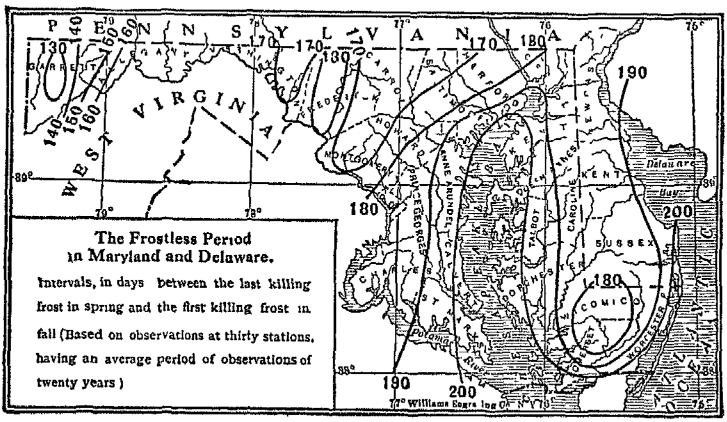


FIG 83 —Note the influence of water and of moderately elevated ridges to lengthen the growing season, and of high plateaus to shorten it There are ridges in Frederick and Allegany Counties, and high plateaus in Garret County (After O L Fassig, United States Weather Bureau)

some of them covering more than a square mile, but the sweeping cold waves that come unimpeded down the open Mississippi Valley have frequently frozen the fruit buds in April and May, and some of these apple districts are not prospering On the other hand the nearby Ozark plateau of southern Missouri and north Arkansas, an old worn-down mountain system, are ill suited to grain farming, but very well suited to the production of fruit. The elevation and the protection of mountain location against sweeping cold winds cause it to escape many of the freezes that are so destructive in the open plains to the north and east. The ridges have the advantage of "frost drainage,"

so important in giving the mountains an advantage in fruit growing Cold air is heavier than warm air and on still frosty nights it settles to the lowland where fruit buds freeze while the hills remain frost-free This advantage is so pronounced that at times a difference of 10 feet in elevation saves a crop In the year 1907 the crop in the open valley from the Appalachians to the Great Plains and from the Ozarks to Canada was almost entirely destroyed by cold waves, but a single Arkansas county in the southern Ozarks, immune from these particular May cold waves, produced over $2,000,000 worth of apples Near the corners of Kansas, Nebraska, and Missouri orchards have frost drainage on bluffs overlooking the Missouri River.

The Rocky Mountains and the Northwest. In the more newly settled states of the Rocky Mountains and north Pacific Coast there are many irrigated apple-growing districts Some of these, as the Hood River Valley in Oregon, the Yakima and Wenatchee Valleys in Washington (Fig 84), Bitter Root Valley, Montana, and Delta, Colorado, have already become well known in the eastern part of the United States through the beautiful fruit they send out Parts of Idaho, and a few sections of California are equally well fitted for the growth of this fruit. Because of the bright sunshine of the semi-arid district, the apples grown there are the most beautiful produced in America The production of this northwestern region has increased more rapidly than that of any other section of the United States. In 1923–24 overproduction seemed to threaten the United States.

Under good storage conditions some varieties of apples will keep well for a full year, so that cold-storage warehouses, refrigerator cars, and refrigerator ships have made possible not only the easy distribution of American apples all over this country, but also their export to Europe, and have also made possible their sale and use every day in the year

5 The Peach

The peach tree, unlike the apple, yields well only in restricted localities under special climatic conditions. The peach buds are less capable of resisting spring frosts and low winter temperatures than those of the apple. The fruit requires a warm sum-

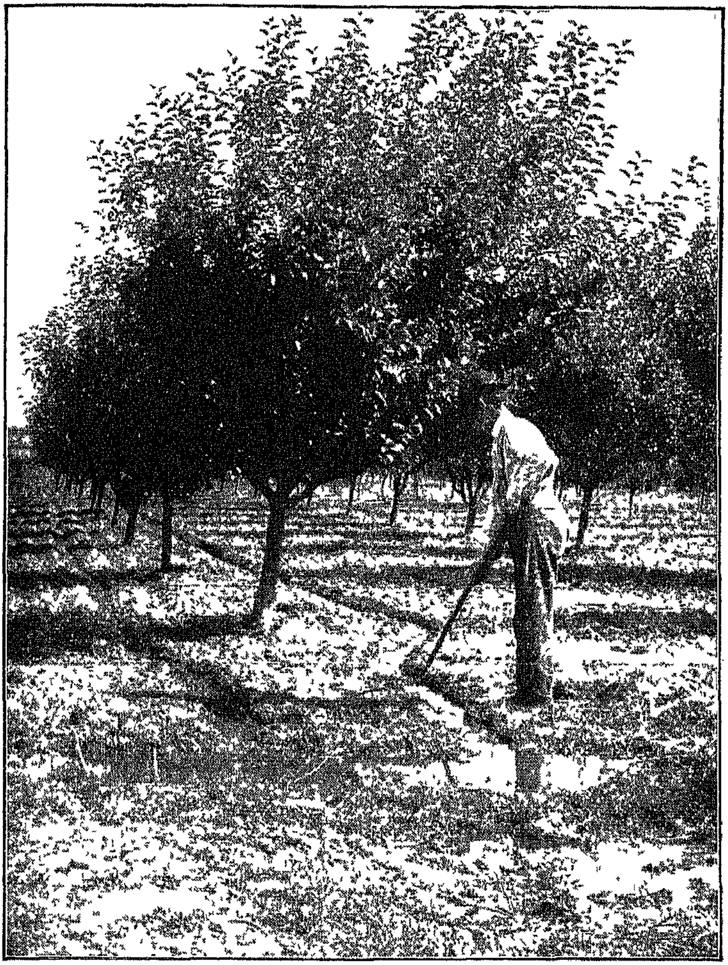


FIG 84—Furrow irrigation of four-year-old apple trees at Wenatchee, Washington (United States Dept Agr)

mer and much sunshine for proper ripening (Fig 85). This condition does not exist in Germany, Holland, Belgium, the north of France or Great Britain, and the tree can only be grown in these countries under the artificial conditions of hot-houses or on the south side of walls where the tree is trimmed so that it spreads out like a fan against the flat surface, thus

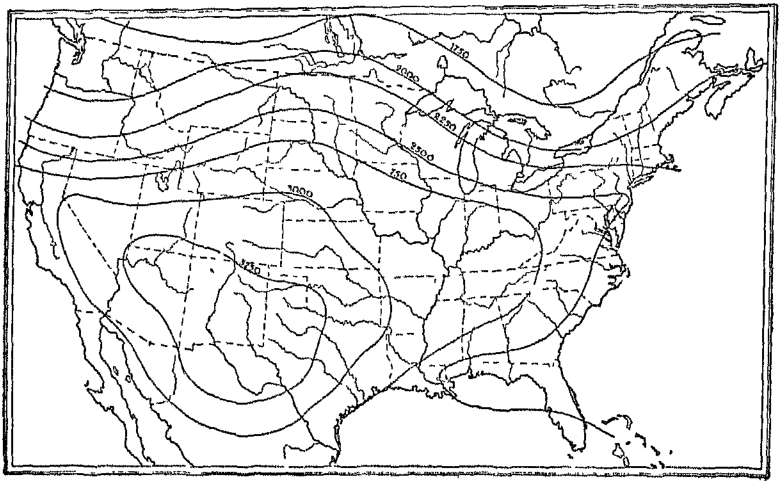


Fig 85 —Map showing mean annual number of hours of sunshine in the United States (After Salisbury, Barrows, and Tower) Sunshine has great influence on plant growth, and aids greatly in giving color to fruit

catching the direct rays from the sun and the heat reflected from the wall.

In the United States the peach industry has sprung up in eight localities, where the danger from spring frost is slight

The peach belts of the Great Lakes. Two of these localities are near the Great Lakes, whose cold surface makes the cool spring temperature that serves to delay the blooming of the peaches until after the frosts The first of these is in the part of western New York where apples are important Its production is so great that some seasons there is no market for some of the fruit The second peach belt, determined by the Great Lakes, is on the eastern shore of Lake Michigan where the prevalent west winds, blowing inland from the lake, give the necessary

temperature control over a belt, less than 10 miles in width. In the same latitude upon the opposite shore of the lake the peach is of no commercial importance.

The Chesapeake Bay and the Allegheny regions. A third peach belt is in the peninsula east of the Chesapeake Bay in the states of Delaware and Maryland Here, upon sandy soil thought to be ill suited for growing grain, grass, or live stock, and somewhat protected from frosts by the adjacent waters, arose shortly after the Civil War the first great centralized peach business in the United States It has been discovered within recent years, however, that the climate of the ridges in the Allegheny region, to the west of the Great Valley, is better for peach growing than that of the coast plain The coolness due to elevation causes a later start in spring growth and the slopes have also the advantage of frost drainage Due to these advantages the fourth peach belt developed rapidly upon the mountain slopes of the Blue Ridge and the Alleghenies in the Potomac drainage basin in southern Pennsylvania, western Maryland, and the eastern part of West Virginia

New England. The ability of the peach to do better upon mountain tops than upon lowlands has led to the discovery that it can be grown upon many of the higher hills of southern New England Consequently prosperous orchards have yielded good crops on the hilltops overlooking the Connecticut Valley in the state of Connecticut, but the danger of killing freezes in midwinter will probably prevent any extended peach industry here.

The Ozark region. In the central part of the country the Ozark ridges furnish some frost protection in the vast plain where cold waves are perilous to the peach. This gives rise to a sixth peach district in Arkansas and southwestern Missouri

The southern peach districts. The seventh peach district is in the South Since fast freight service has been established upon the railroads, it has been found possible to grow fine crops of peaches on southern cotton land (in central Georgia and Texas) and market them in northern cities some weeks before the crops of Maryland, New York, or Michigan are ready The industry has developed to such proportions that Georgia sometimes ships several hundred cars a day in the height of the season. The chief advantage of the South in peach growing is

the absence of rival producers when its crop is ready to market, rather than greater certainty of production

California peach growing. California, with the eighth and last peach belt, produces about one-third of the American crop Bordering upon the Pacific Ocean with the mild winter produced by the prevalent even-tempered westerly winds from that great body of water, this state has a normal oceanic climate free from the cold waves and strong winds that spread over all territory east of the Rocky Mountains Peaches can, therefore, be cultivated with fair assurance of getting a crop, although frost destruction is sometimes known there In the seven-year period, 1917–23, California has had a steady production ranging from 12 to over 17 million bushels None of the other peach districts except Georgia have escaped bad years. California peach orchards are of great extent, and, owing to the perfection of the methods of picking, packing, and shipping, California peaches, in seasons of short crop in the East, are sent to all the larger eastern cities and at times even as far as London The bulk of the crop, however, is grown for the purpose of drying or canning, the large sized, firm-fleshed, California canned peach being a favorite on the market.

6 Combating Pests

The fruit trees are mostly exotics and the trees as well as fruits are often tender and very susceptible to insect and fungus attacks. As a result of our world commerce and the introduction of new varieties of plants, each locality also gets most of the world's weeds and other agricultural pests. Thus came many insects, fungi (rusts, blights, mildews) and other plant enemies which combine to destroy or injure nearly all the fruit that forms on the trees of the unprotected orchard. Fortunately they can usually be held in check by skillful care, much of which consists in spraying poisonous liquids on the trees (Fig. 86). This makes the production of good fruit one of the most scientific of all pursuits, and is transferring it from the small orchard of the general farmer to the large orchard of the specialist in the better located fruit districts.

The history of peach growing in the Michigan district gives an excellent example of the dependence of industry upon science.

A mysterious, incurable, and fatal disease called "the yellows" spread from tree to tree. Unchecked it worked destruction in the west Michigan peach belt and reduced the number of trees in one county from 600,000 in 1870 to 30,000 in 1884. This reduced the value of land to $10 or $20 per acre when it had been worth from

FIG 86 —Spraying an apple orchard in Virginia with poisonous mist to kill insects (United States Dept Agr)

$50 to $100, and brought communities to the verge of bankruptcy At this point it was discovered at the State Agricultural Experiment Station that if every tree having the yellows was removed when the disease was first discovered, only 1 or 2 per cent of the trees per year would be killed, and the peach industry could thrive. After the adoption of this precaution the county

that had but 30,000 trees in 1884 had over a million in 1906, and throughout the peach belt prosperity again prevailed

Dried fruits in the domestic epoch. Before the coming of steam transportation, when each locality lived to a great extent

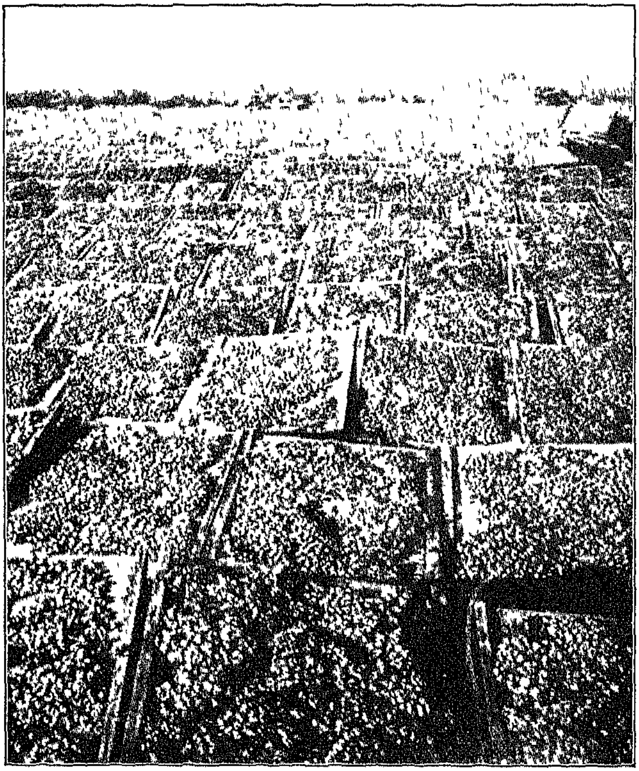


FIG 87 —A rainless summer helps to locate the dried-fruit industry by permitting it to be dried upon trays in the orchard, California. (United States Dept. Agr)

upon the local resources and the farmer's family lived almost entirely upon the products of its own farm, the drying of fruits in humid America and Europe was almost as common as their production. But in damp or cloudy weather it often spoiled in

the process If it succeeded, the humidity made it dark and unattractive in appearance The only other methods of preservation were the then expensive ones of preserving them in sugar, brandy, or spice, or of pickling them in vinegar, which latter process made of them merely a condiment. Steam transportation and world commerce have worked a quick revolution by developing a large traffic in dried fruits from those parts of the world having unusually favorable conditions for their production.

Dried fruits in the modern epoch. It has become easier to dry fruit in the sunny and rainless summer of countries having the Mediterranean type of climate (Fig. 87) and ship it great distances than to combat the difficulties of drying it in less favored localities with artificial heat in evaporators The only exception to this is the drying of apples, an industry still centered in New York State, where large quantities of apples otherwise unsalable are utilized in this way.

In almost any grocery store in the United States to-day, boxes of dried prunes, apricots, peaches, dates, raisins, figs, and currants may be seen, and the names and addresses stamped on the boxes will show that they have come into these American communities from many distant parts of the world. They are nearly always from districts with a long dry summer, in which fruit exposed on trays beside the trees is dried by the constant sunshine with great ease and little labor except piling the trays and covering them on those rare occasions when rain threatens But a threat of rain does bring a furious scramble of speedy work

Distribution of the dried-fruit industry. The dried-fruit industries grew up first in southern Europe and have very recently come to southern California, where they have developed with surprising rapidity and now supply nearly all of the home demand In the case of dried prunes, raisins, and apricots, there is now an export of several million dollars per year in place of a quite recent heavy import of prunes from France, and of raisins from Spain. The Santa Clara Valley alone produced over 60,000 tons of dried prunes in 1921 and the total California crop was 90,000 tons The apricot, much like the peach except that it is more susceptible to frost, is another leading fruit crop, grown throughout the southern half of the state. Apricots are marketed both dried and canned. Raisin grapes are grown chiefly

in the San Joaquin Valley, with Fresno as the center; the 1920 crop reached 177,000 tons, valued at over $41,000,000.

8 Canning of Fruits and Vegetables

The importance of canned foods. The canning process, commercially used about the middle of the nineteenth century, is one of the great boons to humanity Human limitations are well shown by the fact that it took the American Civil War to make us use this wonderful process *which was discovered in 1786.* Many other such processes are now waiting to be introduced. Canning consists in hermetically sealing the food product after heat has destroyed all bacteria. Under these conditions the food keeps almost indefinitely By 1883 the methods of doing this work had been so improved that machinery did nearly all the work, including the soldering of the cans and even the pasting and trimming of the labels (Fig. 88).

Before the coming of railroads and steamboats and the process of canning, a crop of tomatoes could be consumed only within a few miles of the place in which it grew and within a few days from picking time After transportation by rail and boat was organized and improved, the tomatoes might be carried several hundred miles, but they still had to be consumed within a few days After the canning process was perfected and developed into an industry, the perishable products of field or orchard could be preserved for consumption at any time within 2 or 3 years and in any corner of the world to which they could be cheaply carried. This elimination of the time limit on perishable commodities has revolutionized agriculture in many localities by suddenly giving perishable products access to the world market. The distribution of perishable crops now depends upon geographic and economic conditions which make certain localities best able to produce certain products rather than upon the more artificial conditions that until recently compelled their production close to the market of the nearby city.

The importance of the canning process in consumption is even more marked. Most parts of the world can now have many kinds of cheap foods previously unused or even unknown. The workers in a paper mill in the woods of Maine may now eat the

tomatoes and peaches of Maryland, the cherries and apricots of California The same is true of the gold digger upon the Klondike, of the engineer on the Panama Canal, of the rubber gatherers in the jungles of the Upper Amazon, and the whaler who spends a season in Bering Sea. When Nansen and his men drifted in the Arctic ice for years in an attempt to reach the

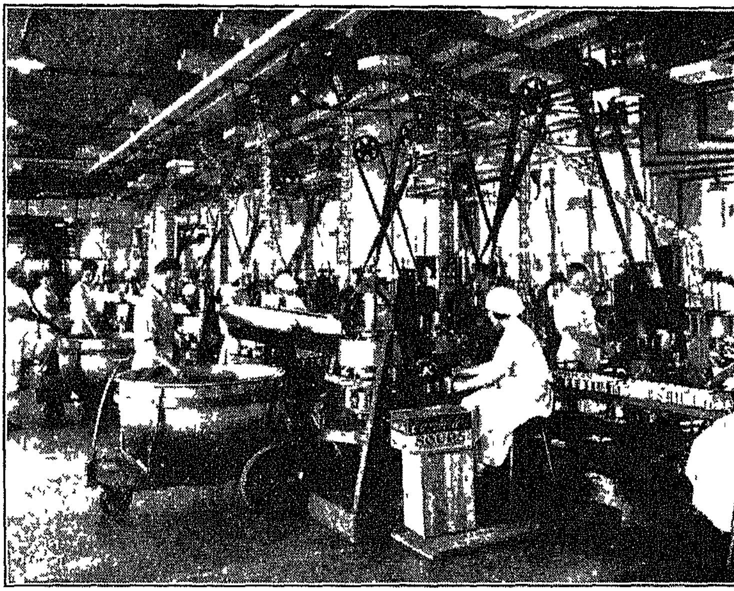


FIG 88 —A food factory Cans are travelling horizontally, vertically and diagonally on endless conveyors In front of the girl they are being filled by a filling machine

north pole, they returned in perfect health because they were nourished with all kinds of canned and preserved meats, vegetables, fruits, fruit juices and extracts

Canning, more than any other invention since the introduction of steam, has made possible the building up of towns and communities beyond the bounds of varied production In New York City the money spent for canned goods exceeds that spent for bread and milk combined.

The extent of the industry. Practically all classes of food—fruits, vegetables, soups, fish, meat, and even nuts, bread, and pudding are now preserved by canning and they are often cooked ready to eat. The canning factories of the United States prepare yearly from 20 to 30 pounds of fruit and vegetables for each man, woman, and child in the country Among the vegetables beans, tomatoes, corn, and peas are of nearly equal importance, while among the fruits the peach leads, followed by apricots and pears The output amounts to many millions of dollars per year, and is produced in nearly all parts of the United States Canning tends to be scattered in small towns wherever a surplus of some product is available, such as may occur in a truck farm or orchard district Although widely scattered, the canning industry in the United States has three distinct belts showing greater development than other regions

The Atlantic Plain. The first of these regions to develop the industry was the Atlantic Plain Maryland is the center and most important part of this canning district which extends from North Carolina to New York This section has become important for the same reasons that made it important in the shipment of truck crops to the city markets, namely, the sandy soil which is exceptionally suited to vegetables, and not well adapted to the growth of other agricultural staples, especially wheat and grain Baltimore is the leading center because of its remarkable facilities for assembling farm products They are brought in steamboats from points as far away as Fredericksburg, Richmond, and Norfolk, in Virginia, and a great number of places on both sides of the Bay of Maryland, while the Chesapeake and Delaware Canal opens a way for the Baltimore fruit boats to go up the navigable creeks of New Jersey to such towns as Salem and Bridgeton. Maryland cans on the average one-third of our tomatoes and a large share of our corn.

The Baltimore canneries have another advantage in the fact that the oyster pack gives employment to both labor and equipment in winter season—a cost factor of great importance

The New York, New England, and Lake Region. New York which is both a great agricultural state and a fruit grower, is the center of the northeastern belt, a region with great diversity of canned products. The New England summer is almost too

cool and short to ripen the grains well For that reason Maine with a very small corn acreage cans a great deal of corn, since corn for canning does not need to ripen but is harvested a full month earlier than it could be if sold as ripened grain. The canning of corn, formerly centered in New York, has now moved west, with Illinois and Iowa as the leading producers. Wisconsin and Minnesota farther north, have a large corn pack for the same reason Maine has The somewhat cool summer that makes parts of New York, Michigan, and Wisconsin second-class corn producers, makes them first-class growers of peas, Wisconsin producing over one-half of the annual pack.

Pacific Coast. California leads all other states in canning. It has become important from the combined influence of the climate, which is excellent for the growth of fruits and vegetables, and the great distance from eastern markets, which makes it possible to ship in the fresh condition only an uncertain fraction, and that the most perfect, of the total crop This state supplies nearly all the canned apricots that appear in our markets, the largest share of the canned peaches, pears, and other fruits, except apples and berries, and is very important in the output of canned tomatoes, peas, and asparagus The canning industry also has large possibilities in the other Pacific Coast states The Willamette-Puget Sound Valleys of Oregon and Washington have a damper, cooler summer than California and for that reason are producing and canning large quantities of blackberries, raspberries, loganberries, and other small fruits

The possibility of increased production and of over production. The possibilities of increase in the production of fruits, vegetables, and canned goods in the United States are very great. One might almost say limitless. Of the sandy Atlantic Plain, so admirable for the growth of small fruits and truck crops, but a small portion is now used, and the production is only kept down by the unprofitable low prices which result from the rather frequent overstocking of the market If, for example, the farmers of the United States could be assured 15 or 20 cents a peck for tomatoes at their farms for the next 10 years, it is probable that tomato production would be increased tenfold, for they are now commonly grown for less than that price and occasionally the crops are so great that the factories cannot handle

them and they rot upon the ground by the hundreds of tons Practically the same thing is true of all the other vegetables, including potatoes This is a great deterrent to industry

Even with the aid of the outlet afforded by canning, the small fruits and vegetables yield so enormously that overproduction, with its glutted markets and frequent losses, is a factor which, like frost, is ever in the mind of the producer and almost annually visits each locality of varied production

Questions

1 What trouble did the early colonists of the United States have with the grape industry? Why? How was it overcome?

2 Can Massachusetts compete with New York as a grape grower?

3 Compare Florida and California as orange-growing states

4 State and explain the influence of the Great Lakes on the location of the apple and peach industries

5 Should the people of Illinois plant large apple orchards? Would it be any better to plant them in West Virginia?

6 How have climatic factors caused a decline in the eastern dried-fruit industry?

7. What is the canning process and what has been its influence on the time limit and the space limit for the use of perishable foods? Its effect on the adjusting of farming to resources?

8 Why is peach growing an important industry in western Michigan, but not profitable just across the Peninsula on Lake Huron?

9 Suppose all the good orange land in the United States were immediately put into orange groves, how would this affect the industry?

10 Explain "frost drainage" How does this become a factor in locating suitable orchard land?

11. Why is it necessary to kill bacteria in the process of canning?

CHAPTER V

SUGAR AND TOBACCO

1 Sources of Sugar

Sugar is one of the few foods that are all nutrition. Its general use among the people of the temperate zone is a recent development It has rapidly passed from a luxury to a necessity, and its use has increased to the point where it is a menace to the national health. In 1589 a pound of sugar in England cost as much as a quarter of veal To-day its cheapness places it in reach of every family The United States is the greatest sugar-consuming country in the world with an average of two pounds a week per person.

Nearly all plants, even onions, have sugar in their sap at some time in their growth, so there are many sources of sugar. Some of the more important of the sugar-storing plants are beets, carrots, and parsnips, which hoard it for use in the second year of their growth when they suddenly burst forth with heavy tops, blossoms, and seeds In the tropics several palms are used to some extent for sugar manufacture But sugar cane is the greatest plant of the world. It is a plant much resembling an earless stalk of corn filled with sweet juice, and it grows throughout the moister parts of the tropics. In its natural condition it is so superior to other sugar yielders that (excepting honey) it was practically the only source of commercial sugar supply until the nineteenth century, when beet sugar came into prominence Throughout most of the wet tropic sections of the world a section of the stalk of the sugar cane from which the sweet sap can be sucked is a prized but common morsel and an important article of food.

2. Cane Sugar

Climatic requirements and distribution. Sugar cane is as distinctly limited to warm climates as the beet is to cool ones.

It will grow with short life and meager yield on the sub-tropic edges of the temperate zones in such districts as Louisiana, Natal, New Zealand, and Cape Colony, but it is cultivated in the frost zone only where there is a long growing season, and where tariffs or bounties give freedom from competition with the tropics. The best cane yields require such conditions as exist in Cuba, Java, and parts of Brazil, and India, where there is a temperature of 75 or 80° F the year round and a rainfall of 60 inches or an equivalent amount of water by irrigation. The necessity of much sunshine gives irrigation a great advantage

The superiority of the tropics for cane growing is in climate rather than soil In the frost-free climates there are records of fifty yearly cuttings from one planting, and the Cuban plantations regularly cut eight or ten crops from one planting Those of Louisiana, because of our freezing winter, yield but one good harvest, followed by a much smaller one, and one-third of a crop is required to furnish the cuttings for planting the next crop Cold rains in December have sometimes caused a loss of millions of dollars in Louisiana in a single year Owing to these climatic limitations cane-sugar production in the United States attains importance only in the southern third of Louisiana, in a coast strip in eastern Texas, and in a few locations in Florida. The Everglades of Florida have the best sugar climate in the United States but most of this swamp is as yet undrained The sugar territory of southern Louisiana is part of the swampy flood plain of the Mississippi River. The only tillable land is within a mile or two of the streams, where the flood-deposits have built up a strip of rich land a few feet higher at the river bank than it is a short distance away where it merges into the flat, untillable swamps

Methods of cultivation. Cane does not require such careful handwork as the beet It is weeded with plows and hoes not with fingers, by men, not by children; and even the steam plow may do much of the work, as has been proved in the British island of Trinidad, and in Hawaii. The method of planting consists in putting cuttings in the ground, or, as is the practice in Louisiana and Cuba, in laying in the bottom of a furrow a row of cane stalks which send up sprouts from every joint. After 8 months or more of growth and cultivation the leaves fall

off or are stripped off, and the stalks are cut by hand and hauled away to the factory

Products obtained from cane. In the sugar factory the cane is crushed to extract the juice. The juice is boiled until most of the sugar crystallizes, and these crystals are refined and packed for the market

After the sugar crystals have been removed there remains an uncrystallizable residue called molasses, which may with ease be distilled into rum, long an important export of the sugar-growing West Indies The importation of West Indian molasses and the manufacture of rum was an important industry in colonial New England England's interference with this trade was one of the causes of the Revolutionary War The market for molasses is limited, and now much of it is used for the distillation of industrial alcohol and the preparation of commercial cattle feeds.

The extraction of cane syrup for local use is a simple process rather widely practiced in the Gulf region of the southern states, and a little cane is grown for this purpose as far north as Arkansas and eastern North Carolina.

The national sugar supply. The United States, with a sugar consumption of over four and one-half million tons, has been growing cane sugar for over a century, beet sugar since 1890, yet the import increases year after year, in spite of the fact that home production has increased fourfold in the last 30 years. The cane fields of Louisiana and the Gulf Coast are able to supply less than one-twentieth of our needs. One-fifth of our supply comes from the beet fields. Cuba is our great source of sugar, the United States taking the bulk of the Cuban crop, which makes fully half of our national consumption every year. Our island neighbor seems likely to retain this preferred position in the American sugar market for many years to come, due to the factors of climate and geographical location.

The United States island possessions. Sugar production in Hawaii, Porto Rico, and the Philippines has increased much faster than in Louisiana. Next to Cuba our three tropical island colonies supply the largest amount of sugar for the American market, or nearly one-fourth of our annual consumption Over half a million tons of sugar is annually produced by each one,

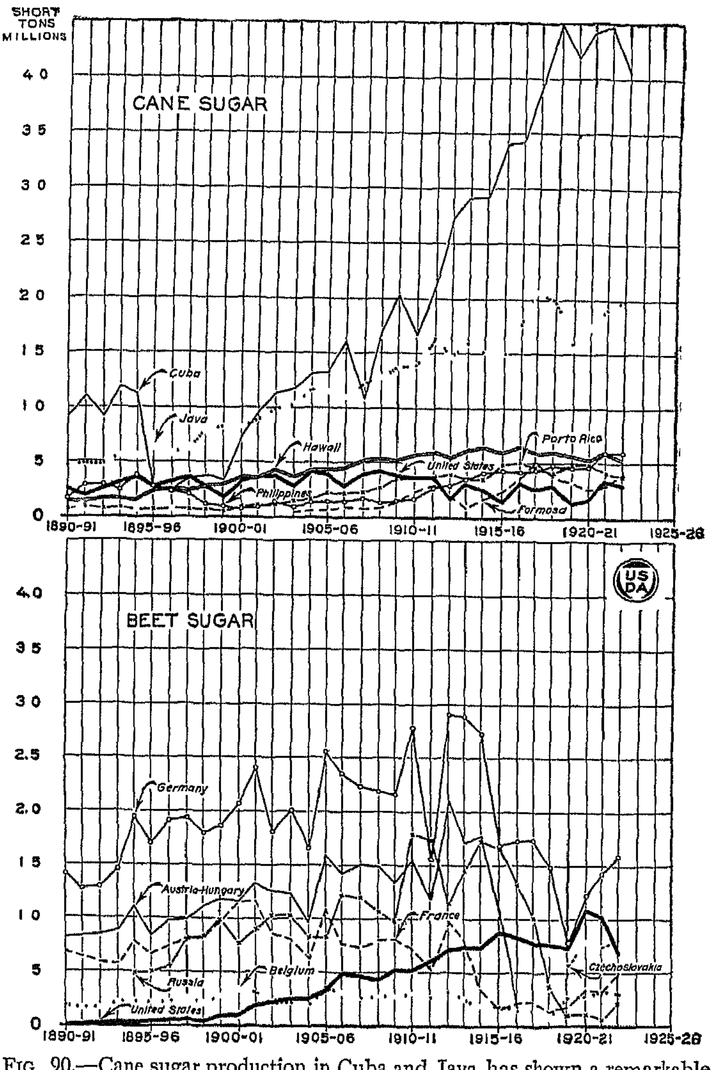


FIG 90.—Cane sugar production in Cuba and Java has shown a remarkable expansion in 25 years. With the beginning of the war in 1914 beet growing—largest in the warring countries of Europe—fell off greatly The United States has now risen to third rank in beet sugar production.

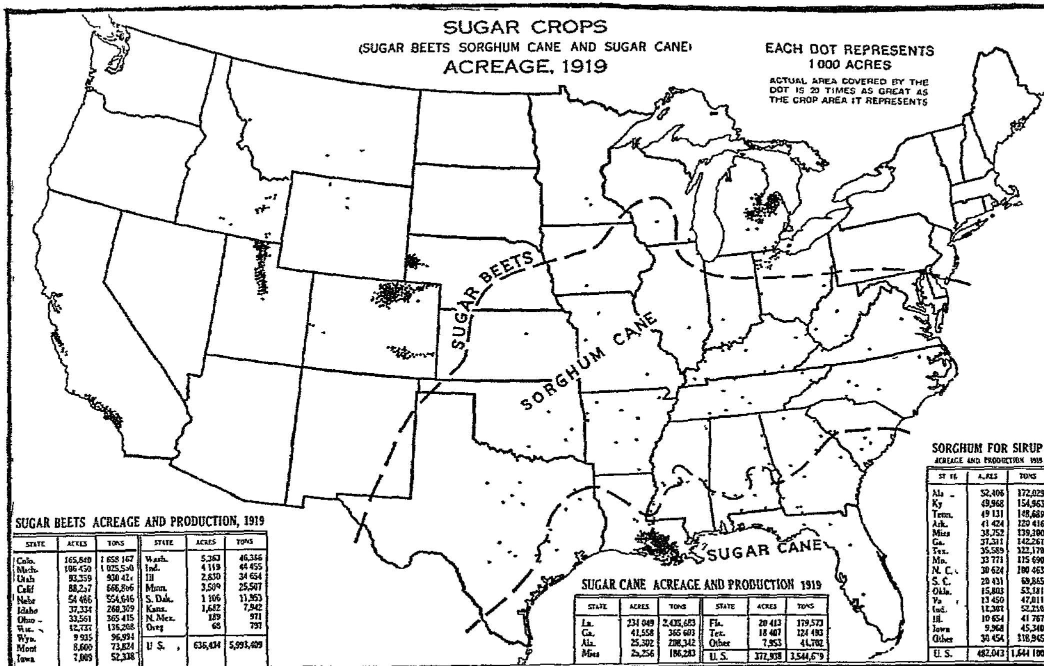
or more than is grown in the entire continental United States Hawaii furnishes 11 4 per cent of the United States supply (1918-22), while Porto Rico contributes 8 2 per cent and the Philippines 2 7 per cent

The sugar yield per acre in the Hawaiian Islands is the largest in the world, due first to the virgin fertility of the phenomenal soil, decayed lava from the great Hawaiian volcanoes Fine yields are further produced by intensive cultivation and by irrigation on the lee or dry side of the islands In the absence of suitable rivers at the right elevation for stream diversion the water is gathered near the sea level from streams and wells and pumped up, sometimes hundreds of feet, through iron pipes and spread over the fertile lava slopes, making some of the most spectacular plantations in the world Hawaiian crops have averaged over 9,000 pounds of sugar to the acre, twice the harvest of West Indies or Java, and these islands in turn yield better than cane fields upon the rich delta of the Mississippi where the climate is too cool for the best growth of cane

Hawaii has had the especial advantage of receiving a higher price than any other sugar exporter except Porto Rico. This high price was due, before the islands were annexed in 1898, to the reciprocity treaty of 1876, admitting Hawaiian sugar to the United States without the payment of duty. The 11,000 tons produced in 1875 grew to 250,000 in 1899, and 605,000 in 1923 Since annexation all of the export goes to the United States free of duty.

This special privilege to the sugar growers of Hawaii has led to high profits and the neglect of other industries in the islands These profits began when the islands had a few thrifty white people and many easy-going natives, giving an admirable opportunity for the formation of great estates Cane production in Hawaii has about reached its economic limit because most of the suitable land has been planted

The Philippine Islands have admirable soil, temperature, and rainfall for the growth of cane The sugar industry was retarded for years by the lack of modern equipment and the fact that hemp and copra paid bigger returns, while Philippine sugar also received a less favored tariff treatment than Hawaiian It was not until 1913 that Philippine sugar was admitted into the



SUGAR BEETS ACREAGE AND PRODUCTION, 1919

STATE	ACRES	TONS	STATE	ACRES	TONS
Colo.	165,840	1 658 167	Wash.	5,363	46,386
Mich.	106 450	1 025,530	Ind.	4 119	44 455
Utah	93,359	930 42[illegible]	Ill	2,830	34 654
Calif	88,2[illegible]7	666,8[illegible]6	Minn.	3,509	25,507
Nebr	54 486	554,646	S. Dak.	1 106	11,953
Idaho	37,334	260,309	Kans.	1,682	7,942
Ohio	33,561	365 415	N. Mex.	189	971
Wis.	12,737	136,208	Oreg	65	797
Wyo.	9 935	96,994			
Mont	8,600	73,824	U S.	636,434	5,993,409
Iowa	7,009	52,338			

SUGAR CANE ACREAGE AND PRODUCTION 1919

STATE	ACRES	TONS	STATE	ACRES	TONS
La.	231 049	2,435,683	Fla.	20 413	179,573
Ga.	41,558	365 603	Tex.	18 407	124 493
Ala.	25,302	208,342	Other	7,953	44,702
Miss	25,256	186,283	U. S.	372,938	3,544,679

SORGHUM FOR SIRUP
ACREAGE AND PRODUCTION 1919

STATE	ACRES	TONS
Ala.	52,406	172,029
Ky	49,968	154,963
Tenn.	49 131	148,689
Ark.	41 424	120 416
Miss	38,752	139,300
Ga.	37,311	142,267
Tex.	35,589	122,170
Mo.	33 771	115 690
N. C.	30 624	100 463
S. C.	20 431	69,865
Okla.	15,803	53,181
Va	13 450	47,011
Ind.	12,307	52,230
Ill.	10 654	41 767
Iowa	9,968	45,340
Other	30 454	118,965
U. S.	482,043	1,644 180

FIG 91 —Distribution of sugar crops in the United States Between the two important sugar-producing crops of cane and beet is a broad belt with a thin and scattered acreage of sorghum cane, most of which is made into sirup on the farm and is unimportant in commerce (United States Dept Agr)

United States duty free Since then the production of sugar has tripled, with possibilities of still greater expansion in the future Large areas of suitable lands are as yet undeveloped, but the labor supply is a problem Owing to the distance the natural market for Philippine sugar seems to be in the Orient rather than in the United States

3 Beet Sugar

Science and beet culture. The beet-sugar industry affords one of the best examples of the service that science renders to man The stoppage of tropic trade during the Napoleonic wars started a search among French plants for a European sugar supply This resulted in definite attempts to increase the sugar content of the beet which was then about 3 per cent. In 1836 it took 18 pounds of beets to make a pound of sugar, in 1882 about 10 pounds sufficed, in 1904 less than 7 pounds yielded a pound of sugar This great improvement has been brought about, chiefly in Germany, by the practice of systematic selection Within the life span of a man it has trebled the sugar content of beets and, along with improvements in the process of sugar extraction, made possible one of the great agricultural industries of the temperate zone The improvement has not yet ended. In 20 years the amount of sugar produced per ton of beets in the United States increased 25 per cent.

Requirements for the beet-sugar industry. The conditions for beet-sugar production are exacting—a moderate amount of spring and summer rain, a summer of moderate heat, and a cool, dry autumn Corn-growing climates, for example, are in the main too warm in mid-summer so that beets and corn do not grow best in the same localities, the beet belt being on the cooler margin of the corn belt. The irrigated regions of the West, where the autumn is dry and the nights are too cool for corn, furnish the best conditions for beet growing in the United States.

The growth of the sugar beet requires much care and labor. The soil must be fertile, mellow, rich in lime, and neither too clayey nor too sandy. It must be finely prepared, and plowed so deeply that a sub-soil plow must often follow the ordinary plow. Caring for the crop is most laborious because of the large

amount of hand labor required The young plant is so small that only human fingers can rescue it from the up-springing weeds, so that men, women, and children, especially women and children, go into the fields in nearly all beet regions and spend days upon their knees weeding the young beets (Fig 92). A little later, when the plants have become established, they must be thinned out with the hoe Thus far the inventors of ma-

FIG 92 —Women and children weeding a sugar-beet field, western United States (United States Dept Agr)

chinery have been unable to replace either of these kinds of hand labor

It is quite common in the beet-growing districts of the United States for the hand labor to be done on contract by newly arrived immigrants The peasant from Rumania, Hungary, or Poland, accustomed to the growth of beets, will contract at so much per acre to take care of the beet fields With the assistance of his wife and children, he then takes entire charge of the crop for the American farmer

After the plant is established there must be many cultivations, and in the late autumn the beets are plowed out of the ground and the tops pulled off. The roots are then piled in heaps which are covered with straw and sometimes with earth, to await their delivery to factories throughout the winter months Here the beets are ground to pieces, the sugar soaked out of them in hot water, and finally crystallized and sent to the refinery to be put into final form The beet-sugar factory, to be economical, must be large, costing a million dollars or more

Distribution of the beet industry. As a natural result of the intensive labor and the peculiar climate required, the sugar-

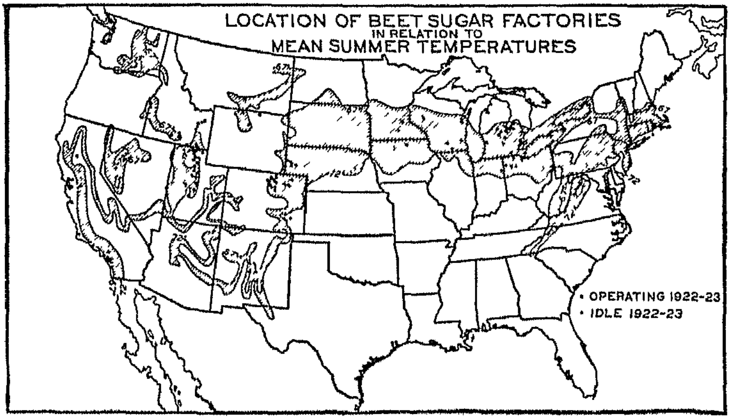


FIG. 93.—The shaded area shows where the sugar beet grows best and the dots indicate the location of beet-sugar refineries in the United States. Notice the isotherms which bound this beet zone (United States Dept Agr)

beet industry was late in becoming established in the United States With its heavy labor requirements it did not interest the American farmer, while corn land was still to be had for the taking. Here as in Europe it could only compete with cane by the aid of a tariff. We had a production of but 3,000 tons in 1890, but, stimulated by a high tariff-made price, it passed the cane crop of the United States in 1906 (see Fig 90), and the crop of 1923–24 was 931,000 tons. Yet the import of sugar is the greatest item in our import trade (see table of food imports in appendix). The possible beet area of the United States is several

times as large as the possible cane area, and seems to follow rather closely the July isotherm of 70° which traverses the United States for nearly 5,000 miles (Fig 93). The principal beet-producing localities in the United States are in the four irrigation states of California, Colorado, Idaho, and Utah, and in Michigan, and to a lesser extent in Wisconsin on the glacial areas too far north for corn and not well suited to grass Michigan, Wisconsin, and Nebraska have areas of light sandy loam, excellent for beets, but not well adapted to other staples.

In northern and central Europe, where the populations are dense and the climate suits the beet and does not suit corn, there

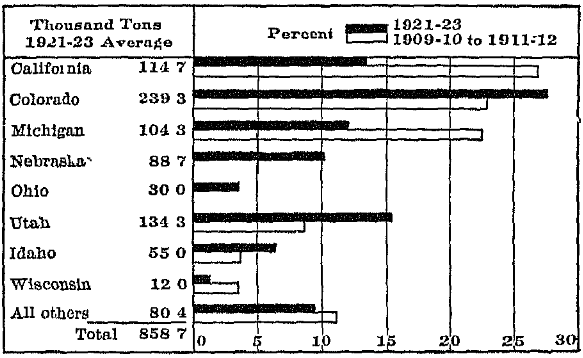


FIG 94 —United States beet-sugar production, three-year average.

are stronger reasons for growing the sugar beet than we have in the United States Especially does its heavy yield per acre make it a suitable element of an intensive agriculture It thus becomes a great crop from northern France through Belgium, Holland, Germany, Czecho-Slovakia, Hungary, Poland, and Central Russia Prior to 1914 Europe produced 90 per cent of the beet-sugar, which made up about one-half of the world's sugar supply. The war caused a shift in production areas, so that the sugar crop of 1923 was 70 per cent cane and only 30 per cent beet

4. SUGAR FROM SORGHUM

Another sugar plant, sorghum, a member of the corn family and resembling both corn and cane, has long been grown in

southern, central and southwestern United States for the manufacture of syrup for local use (Fig 91) The juice is extracted in the same way that sugar-cane juice is extracted for syrup making A century ago this plant exceeded beets in the sugar content of its juice, but progress in improving it has been slow. Experiments carried on for many years at Fort Scott, Kansas, have at last resulted in the making of satisfactory sugar from it Now that the laws of plant breeding are better known, the sugar content of sorghum may be capable of as great an increase as has taken place in the beet. It is quite possible that a century

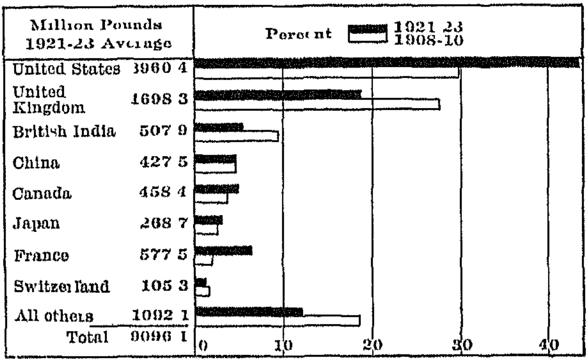


FIG 95 —World's sugar import, three-year average This shows the inadequacy of the United States crop.

hence it may rival or even displace beets and sugar cane in the United States, because it grows like corn in the corn belt and beyond (see chap. on cereals) and can be cultivated with work animals and machines.

5. Maple Sugar

Maple sugar is produced by the evaporation of the sweet sap of several varieties of maple which will grow over large areas of eastern and northern United States, and adjacent parts of Canada, where it was a very important factor in the days before world commerce in sugar. The crop of 1860 was three times that of 1919. Vermont and New York are the leading states, but a little is produced from Maine to Wisconsin and West

Virginia. Maple sugar costs more than either beet- or cane-sugar and would have no place in the world market at all but for its peculiar flavor and fine quality, which make it something of a luxury and enable it to command a higher price The sap flows only in quantities sufficient for satisfactory sugar making where the early spring days are bright and sunny and the nights are cold. This climatic factor limits sugar orchards to the region from Indiana east and north It is particularly important in the White Mountain region of Vermont and New Hampshire and the adjacent parts of Canada.

The sugar maple tree that yields from the time it is 20 or 25 years old till it is 75 or 100, on rocky land without cultivation, certainly has all other sugar producers distanced for permanence, but the yield is at present low. As yet nothing has been done to improve the breed of sugar maples Interesting possibilities present themselves when one considers what has happened to the beet Much of the output of the "sugar-orchards" is marketed in the form of the more easily made maple syrup, a highly prized table delicacy.

6 Tobacco

Few commercial plants grow over so wide a range of the earth's surface as does tobacco. It is injured by frost, but it grows in a comparatively short season, so that profitable crops ripen as far north as Wisconsin, southern Canada and England, while it is at home throughout the tropics Probably no other commercial product possesses more grades and commercial varieties One field of Sumatra tobacco may be classified into as many as seventy-two different market kinds. The quality of the soil affects it in a remarkable degree, as do temperature, humidity, and especially the fermentation and other chemical changes that take place in the process of curing the leaf. The resulting strength or weakness of flavor, the kind of flavor, the thickness, brittleness, elasticity, texture, color, size, perfection and relative weight of the leaf, its specks, its dustiness, gumminess and ripeness are some of the factors that decide whether the tobacco will bring 2¢ or $2 per pound

Tobacco's commercial service. The commercial service of tobacco has been great, likewise its injuries to man and to his

resources. The Jamestown Colony in Virginia was about to fail in its early days because the settlers could find no money crop, nothing to sell to the mother country in return for the imports they must buy from her England, being then essentially an agricultural land, had an abundance of wheat, oats, barley, rye, and all agricultural staples as well as manufactures. The colonists tried to grow silk, but failed The grape also failed (see chap on fruits) and despair ruled in Jamestown. Then a trial shipment of tobacco which the Indians had shown the colonists how to grow, brought a good price in England. It promptly

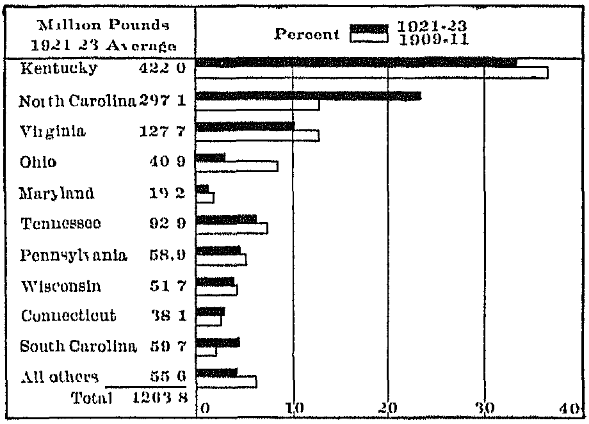


FIG 96 —United States tobacco production, three-year average.

became the great staple of trade, remained so throughout the whole Colonial period and to a very considerable extent down to the present time. As late as 1810 it was one of the few crops that could be sold by the people of Kentucky and Tennessee, whose export market was New Orleans, reached by flat boats which were floated down the Ohio and Mississippi Rivers

The use, spread, and consumption of tobacco. The increase and spread of the use of tobacco have been phenomenal, and of late years new industrial uses for it have been discovered (Figs. 96 and 97). The dust made of tobacco stems is a fertilizer rich in potash and the nicotine also kills the destructive aphis on the roots of fruit trees. This nicotine, which is the cause of the

injury that tobacco inflicts on its users, has of late given rise to the manufacture of poisonous extracts for use as sprays in exterminating insects on the leaves of trees and shrubs

Tobacco growing belongs to intensive agriculture. The tiny black seeds, three or four hundred thousand to the ounce, are sown in seed beds, and the little plants were, until the recent introduction of a new machine, transplanted by hand to their place in the field, where constant attention and hand labor are necessary to protect them from the cut worm which cuts off the young plant, the leaf worm which eats holes in the leaves, and

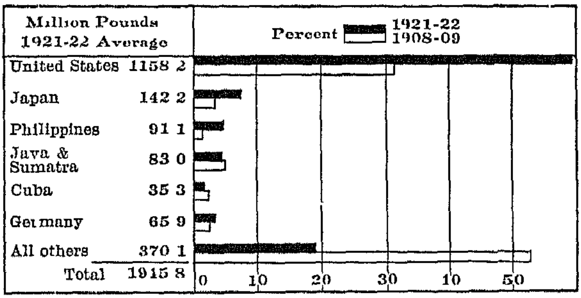


FIG 97 —World's tobacco production, two-year average.

the stalk worm which destroys the central stalk of the plant. The blooms must be picked off, so that the energy may go to leaf rather than seed. For the same reason, the suckers or side shoots must be pulled off, while the processes of picking, curing, sorting, grading, and packing are laborious and require much skill

Tobacco as a crop. The farm value per acre of the tobacco crop in 1923 was $164, more than twelve times that of wheat As much of the labor of tobacco growing requires watchfulness and care rather than strength, it can be done by women and children as well as by men, and as a result it is rarely grown on an extensive scale but usually in small fields, cared for by the members of the farmer's family The tobacco farmer of Virginia and Kentucky usually raises enough corn to feed the horses that work his lands, the pigs that make his meat, and the cow and chickens that help feed the family. He sometimes also raises

some other supply crops, but all his money he usually expects to get through the sale of tobacco.

The leading tobacco belts of the United States. For a long time the Virginia-Carolina tobacco belt running from southern Maryland through the middle part of Virginia and North Carolina was the leading tobacco belt of the United States (Fig 98), but Kentucky has now become the first state, producing in 1923

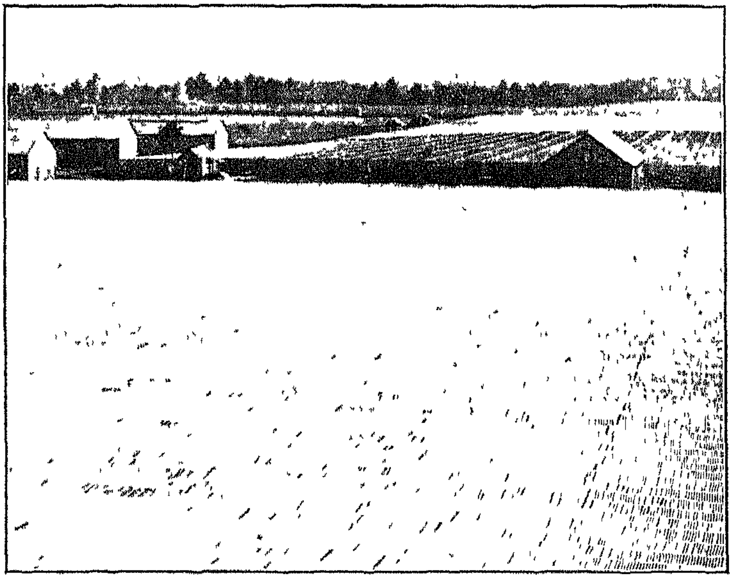


FIG 98.—Plantation of cigar-wrapper tobacco growing under artificial shade in fine sandy loam, Norfolk, Florida. (United States Dept Agr)

over one-half as much as all the states east of the Appalachians Special grades of tobacco are grown in small quantities in restricted districts in Wisconsin, Connecticut, Florida, and Louisiana, but the limestone lands of Kentucky are the chief seats of tobacco production in the United States, and Louisville, their natural commercial center, is the greatest tobacco market in the world. Much Kentucky tobacco is exported to European countries, for the United States is by far the greatest exporter as well as the greatest tobacco grower in the world. Louisville has

many factories for the manufacture of tobacco into the various forms for final use from cigarettes to insecticides. In the eastern field, Richmond is the greatest center, while Petersburg, and the Carolina towns of Winston-Salem and Durham have enormous tobacco factories.

Tobacco injury to American soils. The ready export market for tobacco has resulted in great injury to the soil resources of most American tobacco-growing districts. Because of the good profits, tobacco has been grown year after year without rotation of crops until its great demands for potash have exhausted the soil for a time and the fields have often been abandoned because land was so cheap that more could be had by cutting down and burning the forest. Then the heavy downpours of the summer thunder showers reduced the bare and abandoned tobacco field to gaping gullies before the old-field pine could again make a forest there This wasteful policy brought great poverty to southern Maryland and middle Virginia, and from these sections the people emigrated in such large numbers shortly after the Civil War when western farm lands were opened up, that there was a general loss of population throughout the old Colonial tobacco district. This region to-day has less land in cultivation than it had a century ago, and many localities have less population.

Questions

1 How may science give us new sources of sugar?

2 How does the supply of seed enter in as a factor in the competition of cane and sorghum?

3 Name and describe two minor sources of sugar supply

4 In what ways did the Great War affect the sugar supply?

5. Why does tobacco suit a tenant farmer better than sugar cane does?

6 Discuss tobacco from the standpoint of a money crop, both at the present time and in colonial days What by-products are there?

7 What effect does the heavy cost of a beet-sugar refinery have upon the beet farmer's market?

8 What by-product of sugar cane is used in feeding cattle? Mention by-products of industries treated earlier in the book, that are used in feeding cattle and pigs

9 Ten pounds of mill (black strap) molasses from cane with the addition of 2 pounds of cotton-seed meal, make almost the exact equivalent as stock food for 10 pounds of corn At the present price of corn and cotton seed in your town what would be the price of molasses to make the two rations of equal cost?

CHAPTER VI

FISHERIES

If judged by the products it gives us the sea is very barren as compared with the land Although it covers three-fourths of the world's surface, it furnishes but a small proportion of our food supply. Fish are the cattle of the sea. They derive their support from the vegetable life of the waters. Even the clear water of the sea has countless millions of minute plant organisms, called plankton, which are eaten by many small animal organisms These in turn are eaten by each other and by the fish, but the support of the whole pyramid of marine animal life, like the life of land animals, is based upon vegetation.

The word fishery is applied to the catching of practically any animal that is taken in the water, as oysters, lobsters, whales, and even seals, which are often taken on shore Sea fishery is considered the cause that first led man to sail upon the ocean, and from this beginning, all maritime peoples have had their rise—Phœnicians, Greeks, Norsemen, Dutchmen, Englishmen, and New Englanders The schooner, the fastest of all sailing vessels, was invented and is yet used by the fisherman of Gloucester, Mass , and in recognition of the importance of the sea industry to the state, a dried codfish has, since colonial days, hung in the Massachusetts State House.

The fishing industry, through its connection with sea power and the romance and charm of the ocean, tends to be overestimated as to its real importance All the fish that are caught by Americans annually, worth about $80,000,000 to the fishermen, are only one-half as valuable as the tobacco crop, and not one-twelfth as valuable as the poultry and eggs produced in the United States The fish of all the world are only three-fourths as valuable as the poultry and eggs of the United States

The location of fisheries. Most of the world's fishing industry depends upon two habits of fish which enable us to catch

near the land those that may have passed most of their lives hundreds of miles away at sea The first is the spawning habit of many species which lay their eggs only in rivers or in the shallow waters near the shore. The second is the congregation of fish to feed upon the bottoms, in shallow waters, commonly called "banks" The occurrence of such banks near the shores of northeastern Asia, northeastern North America, and north-

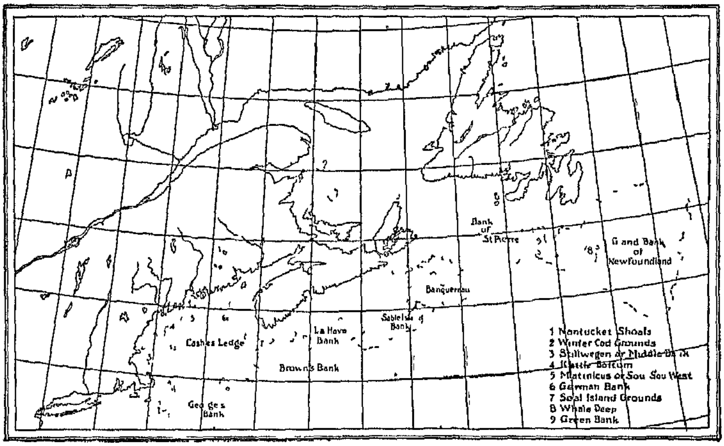


FIG 99—Map showing principal fishing grounds off the coasts of New England, Nova Scotia, and Newfoundland (After MacFarland) (From Salisbury, Barrows and Tower)

western Europe is responsible for the three greatest fishing regions.

The fisheries of northeastern North America are based on a rich combination of rivers, bays, and shallow off-shore banks (Fig 99) Especially important are the Grand Banks of Newfoundland and smaller banks off Labrador, New England, and New Jersey. The Newfoundland banks were known to the fishermen of the French province of Normandy and Brittany within a dozen years after Columbus had returned to Spain from his first voyage Scores of vessels sailed back and forth from France to these Newfoundland banks each year for a century before the French made settlements on Canadian shores.

Proximity to these banks has made fishing a leading New England industry since Colonial times. Massachusetts and Maine have the most important fisheries. Gloucester, Mass, was long the greatest fish port in America, nearly the whole population being engaged in the catching, curing, buying, and selling of fish Boston with its better marketing facilities has recently surpassed Gloucester, and Portland, Maine, is now of second importance in New England fishing

The cod fisheries The most important fish on these and other northern banks is the cod, although the haddock is becoming of nearly equal importance The cod feeds along the bottom and is commonly caught on a "trawl" which consists of baited hooks attached to short lines that are fastened at intervals of 4 feet to a longer line sometimes 3,000 feet in length These trawls are attended to by fishermen in rowboats called dories that put out from the schooners. The men in the dory take up one end of the trawl, which is anchored and marked by a float, pass the boat along under it, and let it down in the water again after the fish have been taken off and the bait replenished Fishing on the Grand Banks is an exceedingly dangerous calling as the banks are one of the foggiest places in the world and the schooners collide with each other and with icebergs. The men in the dories lose their bearings and drift away to death, while a single fearful storm sometimes drowns scores or even hundreds of fishermen. To complete the chapter of dangers the fishing banks are in the path of the great transatlantic vessels which sometimes run down the small fishing craft in the fogs Sometimes also they pick up men lost in dories

The salmon fisheries. Many rivers and bays have a fishing value out of proportion to their area because of the sea fish that annually enter the stream for spawning and become the rich harvest of the fishermen The salmon, of which there are several species, is easily the king of all river-running fish. It lives in salt water but ascends the fresh-water streams to spawn, experiment showing that it returns to the stream where it was born. Salmon are found to some extent in New England and east Canada, but the rivers of the north Pacific, between San Francisco and Japan, are the chief source of the world's supply. In Alaska they have for an unknown period been almost the only

winter food supply of the natives, who at the time of the annual run put away the year's supply of smoked salmon in little houses on high poles, out of the reach of wolves and dogs.

The Pacific Coast salmon industry is the most important fishery in the United States, with an annual catch of over 300 million pounds. It was first established in California, Oregon, and Washington, then in British Columbia and finally in Alaska, where in almost every river, especially the great Yukon, salmon are exceedingly abundant. These fish are marketed fresh, frozen,

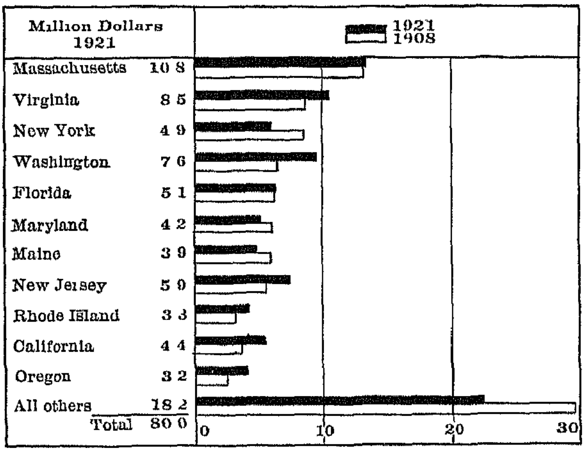


FIG. 100 —United States fishery products by states.

canned, mild-cured, pickled, dry-salted, or smoked. Large salmon canneries have been built at the mouths of various streams along these coasts so rocky, cold, and wet as to be undesirable for human habitation throughout most of the year As the season for the salmon running approaches, sailing vessels loaded with empty cans and carrying many workmen, usually Chinese, leave San Francisco, Portland, or Seattle for the cannery In a few weeks hundreds of thousands of pounds of salmon are canned, loaded into the vessels, and brought back to the home port for distribution The annual salmon pack is valued at $30,000,000, of which one-fourth is exported to the United Kingdom, Australasia, and many other countries.

The shad, probably the most highly prized of American commercial food fish, ascends each spring the rivers from Florida to the St. Lawrence The herring also ascends these same rivers in such numbers that at times their scaly backs cause the surface of the water to shine almost like a mirror The abundance of this fish causes it to be an important article of diet in the eastern part of the United States On the Maine coast small herring are packed in sardine style.

Shell fish. The oyster, of which the United States has from five-sixths to nine-tenths of the world's product, is second only to the salmon in importance This delicious shell fish lives on the sandy and gravelly bottoms of shallow bays and estuaries It is found to some extent on the Pacific Coast of the United States, but the numerous bays between Cape Cod and Galveston, with their large expanses of shallow water of suitable temperature seem to be the best places in the world for oysters The Chesapeake Bay, an old river valley into which the sea has flowed, is the most important oystering district of all, while Long Island Sound is second The oyster, after being hatched from the egg, swims around for a time and then attaches itself to some firm substance, such as gravel, an old shell, or sunken wood For 2 or 3 years he eats whatever the tide brings him, and is then scooped up with long-handled tongs in the hands of an oysterman or by a steam-drawn dredge During the 7 or 8 months of the oyster season they are shipped in barrels and sacks and iced containers all over the United States and even to Europe. The annual pack of canned oysters exceeds $2,000,000 in value, Baltimore having the leading canneries. The natural supply having been found inadequate, oyster culture has been established Beds of young oysters are sometimes planted, that is, put down to grow large, another method is to lay old oyster shells and the bushy tops of trees upon the bottoms of the bays so that there may be something to which the floating spawn may attach itself and grow The oyster industry has declined greatly in recent years, but there are possibilities of extension in Long Island Sound, and in Delaware, Chesapeake and other bays

The importance of fish to the Atlantic Plain of the United States. In the central part of the Atlantic Plain these unusual

fish resources combine with many other resources, to make the peninsula between the Chesapeake Bay and the Atlantic Ocean one of the most favored places in the United States, or, indeed, in all the world, for the easy support of the human race under physical conditions that place no serious handicap on man The climate is wholesome, the varied soil, the abundant, well-distributed rainfall and satisfactory temperature permit the commercial production of an unusual variety of grains, fruits, and vegetables, while fish products reach their maximum of abundance It is the greatest oyster, shad, and herring locality in America, and many minor fish are caught. Herring are so abundant that the laboring man who cares to live cheaply may in the spring time buy a thousand for from $3 to $6, and with a sack of salt and a barrel they can be preserved for the entire year Herring and corn bread make a sustaining meal for a working man, the material costing only a few cents. The shores of these waters are in many places marshy, making excellent feeding grounds for wild ducks as they pass in fall and spring between the wilds of Canada and the swamps of the tropics Hunting and fishing are still important sources of support of the population, who thus make use of the emigrating product of another locality. These fish and wild game advantages are in the main typical of the entire Atlantic coastal plain.

The fish-fertilizer industry. The early American colonists were taught by the Indians to place a fish in each hill of corn for fertilizer The menhaden, a coarse and bony fish which swarms the waters of the Atlantic coast from Florida to Newfoundland, is now caught by millions every year for the same purpose Small fishing steamers carry on the fishing in the open sea, using nets many hundred feet long When a school of menhaden is sighted by the lookout, the net is drawn around the fish, pursed at the bottom, and the fish ladled into the hold The shiploads of menhaden are taken to fish factories, mainly along the Virginia and North Carolina coasts, where they are cooked by steam and pressed, emerging as fertilizer for the farmer's corn, fish oil for soap-making, and fish meal for the fattening of live stock

Seal and whale fisheries. American ports serve as the outfitting place for ships that prosecute these distant industries.

In the first half of the nineteenth century, when whale oil supplied the family lamp, whaling was of very great importance. In those days New Bedford and Nantucket in Massachusetts, and New London in Connecticut, were the great outfitting centers of an industry that was prosecuted in all oceans of the world so persistently that the whale was nearly exterminated by 1860. At that time the fortunate discovery of petroleum lessened the demand for whale oil Some whale fishing is still carried on, but the whalers of Nantucket have changed their base to San Francisco, so that they may be nearer the home of the whale, now chiefly caught in the Arctic Ocean near Bering Straits.

The seal gets its living (fish, shrimp, etc) in the sea, rears its young upon the rocky shores and is the prey of man on both sea and land It is such a valuable quarry that extinction seems to be its fate where it is not protected by strictly enforced legislation. The greatest center of fur seal fishing is the Pribilof Islands, an American possession in the Bering Sea. Here each year many thousands of seals gather from distant seas, and remain for a few weeks during which time the seal pups are born and grow large enough to swim with their mothers Each year a certain proportion of the young males, 2- to 4-year olds are killed, under governmental supervision, the number of pelts taken in 1922 being over 30,000. Most of the skins are sold at the great St. Louis fur auctions. Unfortunately for the seals no country has in past years had any jurisdiction beyond 3 miles from its coasts. The seal at sea was therefore like the whale, beyond the protection of government While the United States could and did protect the seals during their stay on the rocks of the Pribilof Islands, the mother seals daily swam to the open sea for fish, and during many months the whole herd was scattered widely over the Pacific Ocean When more than 3 miles from shore they fell a prey to the rifles of the pelagic sealers from Canada, Japan, or the United States, who sailed the seas in search of them and waited at the 3-mile limit As a result the mothers of many little seals were shot while gathering food, leaving the young to starve on the rocks Thus the number of seals in the Pribilof herds rapidly declined and extinction seemed only a matter of years, just as unchecked and uncontrolled

sealing had practically exterminated, many decades ago, the countless thousands of seals that lived on several uninhabited rocks in the Antarctic. However a treaty (1911) between the United States, Japan, and Canada has probably averted repetition of such an economic insanity in the Bering Sea. Under the careful management of the government the Pribilof seal herd increased from 215,000 in 1912 to 604,000 in 1922

Clams and lobsters yield greater cash return to the American fisherman than the codfish. The clam is a cousin of the

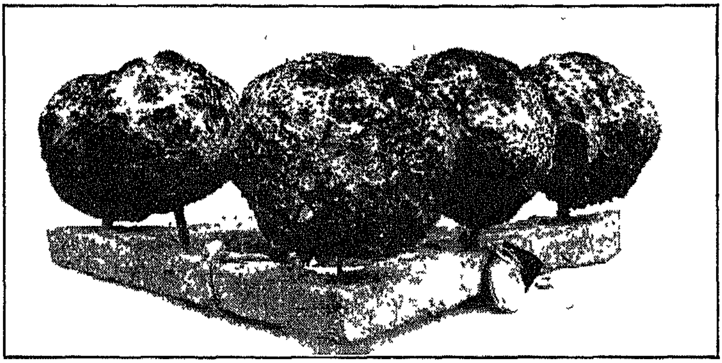


FIG 101 —A new conquest of science Bits of sponge wired fast to cement frames have grown nicely in Florida waters

oyster but possesses power of locomotion and is caught by being dug out of the mud It is especially important along the New England and middle Altantic coast.

The much-prized lobster, a cousin to the crab, lives along the seashore and, from the mouth of the St Lawrence River to the mouth of the Delaware, is caught in a baited box trap called a lobster pot The high esteem of the lobster causes it to bring many times as much per pound as the codfish, necessitating severe laws to prevent its extermination.

The sponge of commerce is the bony skeleton of a marine animal whose jelly-like body is washed out before the sponge is dried for shipment Tarpon Springs, Florida, the center of the sponge industry, is the headquarters for the Greek divers who bring from their beds on the rocky bottom of the Gulf of Mex-

ico the sponges that are regularly auctioned in bunches at the local sponge exchange Increasing scarcity of free sponges has led to promising experiments with sponge-farming, seed sponges being fastened to weights and put upon the sea bottom to grow.

Extension of the fish supply. Fishing without regard to the future has nearly exterminated many species besides the seal. Fortunately, science is able to increase the fish supply With the aid of refrigeration, fish are now caught in the waters of Florida or the West Indies, frozen at once, and marketed weeks later in New York and Europe. Similarly fish are now marketed in the winter season in those markets from the waters off Vancouver Island and other distant places We may, therefore, anticipate a development of the fishing industry in southern waters, which unfortunately are less profilic than those of the North.

Another aid comes from fish culture, an art long ago perfected by the Chinese The threatened extermination of many valuable species of fish has led to systematic fish culture by the United States government. Thus far it has been devoted chiefly to fish hatching and caring for the fry for a short time Billions of fish eggs are hatched and the fry released in streams and lakes to replenish the supply. There are salmon hatcheries in Oregon and Washington, shad hatcheries on the eastern rivers, and lobster hatcheries upon the New England coast. The fresh-water fisheries of the Great Lakes receive the most aid in this respect. The young shad or salmon released by the United States Fish Commission goes away to pasture in the sea and returns fattened for our food supply.

The pollution of interior streams and waterways by industrial waste and municipal sewage constitutes a real menace to the fishing industry. The oyster and the lobster industries are being badly hampered because of the impossibility of breeding and growth in impure waters The introduction of oil as fuel and the rapid increase of oil-burning ships discharging their waste into the harbors have caused many varieties of fish to disappear from their usual haunts. The continued pollution of river and coastal waters may eventually result in cutting short the world's supply of fish foods.

Questions

1 How do the topography of sea bottoms and the habits of fish combine to make an industry for Newfoundland?

2 How do the habits of oysters and of salmon make it profitable for private individuals to increase the supply of these fish?

3 Why is a square mile of river more valuable as fishing ground than a square mile of sea?

4 Why has the fishing industry received so much more aid from governments than some more important industries?

5 How has a treaty probably saved the Bering Sea seals from the fate of the Antarctic seals?

6 Explain how fisheries help provide ham and eggs for your breakfast table

CHAPTER VII

THE FUNDAMENTALS OF MANUFACTURE

A. ABUNDANCE OF LAND

Factors Controlling Manufactures

The basis of manufactures. The manufacturing industries result from a combination of conditions largely geographic in their origin and covered by the terms raw material, power, labor, markets, and capital. Of these factors capital is thoroughly mobile and goes wherever some advantage in one or more of the other three dictates. Raw materials light in proportion to their value go to places where power or labor abound, as iron from Pennsylvania to the Connecticut factories, where firearms, skates, hardware, and other costly metal wares are made. Heavy raw materials sometimes tend to locate an industry near where they are produced, as Birmingham in the midst of the Alabama coal and iron ore area. Fuel and its resultant power are also great factors in locating manufactures as at Pittsburgh, which has an abundance of nearby coal for fuel, but which now has to bring the necessary large supplies of heavy iron ore from the Lake Superior country several hundred miles away.

Nearly all great manufacturing districts are near to sources of fuel or waterpower, for to them come capital, labor, and raw materials. It by no means follows that all coal fields are seats of manufacture. Most of them are not, chiefly because of the lack of the human element, labor, and especially the skilled labor necessary to manufacturing. The relative abundance of labor and natural resources exercises a strong control over manufacturing.

Nearness to market is another important item in determining the location of manufactures that are difficult to transport, especially of food products as in the great city bakeries, and of very bulky and very heavy products, as in mining machine fac-

tories at Denver But nearness to market is a factor of decreasing importance as transportation facilities increase and improve.

Relation of Land and Population to Manufacture

Cheap land opposes manufacturing. We all get our living directly or indirectly from the land. Land is therefore man's great opportunity Where there is little of it per person, there is less opportunity to work, therefore, other things being equal, less return for labor, lower wages, and a necessarily lower standard of life This is usually the most important fact in explaining the industrial history and industrial condition of a nation.

Manufacturing is chiefly carried on by people who work for others, but in America, from the date of earliest settlement to the present, there has been, because of our scanty population and cheap and abundant land, much greater opportunity to work for one's self and less necessity to work for others than there has been in Europe

When the first English settlers established themselves as tobacco growers at Jamestown in Virginia, each had the same opportunity to take up free land and each man preferred to work for himself rather than work for his neighbor If newcomers were brought from England they too could work for themselves, and thus every energetic man wanted many laborers and could get few or none Out of this labor scarcity slavery arose, whereby the Englishman could control his labor. Similar situations tend to produce somewhat similar problems wherever they arise

Throughout the eighteenth century and down to the year 1815, while manufactures were developing and manufacturing towns were arising in England, the young man of America could choose between working for someone else in a manufacturing plant or remaining his own master and acquiring wealth and property by taking a pair of oxen or horses, a wagon, and a few implements and going into the forests of western Massachusetts, New York, Pennsylvania, Virginia, or across the Alleghenies Here by felling trees, building a log house and clearing a field, he could make a home and gain independence The fertile forest land was to be had for the taking, and the young men of America chose to build frontier settlements rather than to go to factories and cities and work for wages.

The free land of the nineteenth century. With the limited means of transportation then in use, most of our available land was occupied by 1810 Profitable and satisfactory farming depends upon good transportation, and good transportation in the United States at that time depended on natural waterways Since farm products could only be shipped from near the banks of navigable waters, desirable land was comparatively limited in amount and therefore the people were turning to manufacturing. Then came the steamboat, and the railroad followed soon after The American people who had been clustered along the seaboard and navigable rivers suddenly found themselves able to take possession of the whole continent, and the vast flat prairies of the Mississippi Valley at once became available for settlement For decades the land was given away by the government to the homesteaders and three generations of Americans triumphantly and truthfully said that "Uncle Sam has a farm for every one of us" From 1816 to 1890 people went from the East to the new West by tens of thousands each year The record of this movement of settlers exceeds anything that had previously occurred in the history of the world. The population of Iowa increased from 192,000 to 674,000 in the decade 1850 to 1860. That of Nebraska rose from 122,000 in 1870 to 452,000 by 1880 and to 1,062,000 by 1890. In the next 10 years it remained practically stationary because droughts checked the farmers' prosperity and the waves of emigration had rolled on to another new and empty frontier Oklahoma, for example, newly opened to settlement, increased from 258,000 to 790,000 people

So excellent were the opportunities to go West and get fine land for nothing, that in many parts of the East people abandoned their farms and the population of Maine and New Hampshire actually declined between 1860 and 1870—typical of what has happened in many agricultural districts throughout the East in the same period and since. Eastern farm lands, often as productive as ever, declined in selling value because of the competition of the western land, and the man who wished to farm could easily begin either east or west So rapid was this settling of western farm land that by 1890 it may fairly be said that there was for a time overproduction of agricultural products Corn

was so cheap in the new country that it was cheaper at times to burn it for fuel than to sell it and buy coal.

Since 1895 the irrigation settlements in the region beyond the 100th meridian have kept before the American people the opportunity to go West and from 1900 to 1924 the Canadian government advertised widely the fact that it was giving away good farms. History has quickly repeated itself. The Mississippi

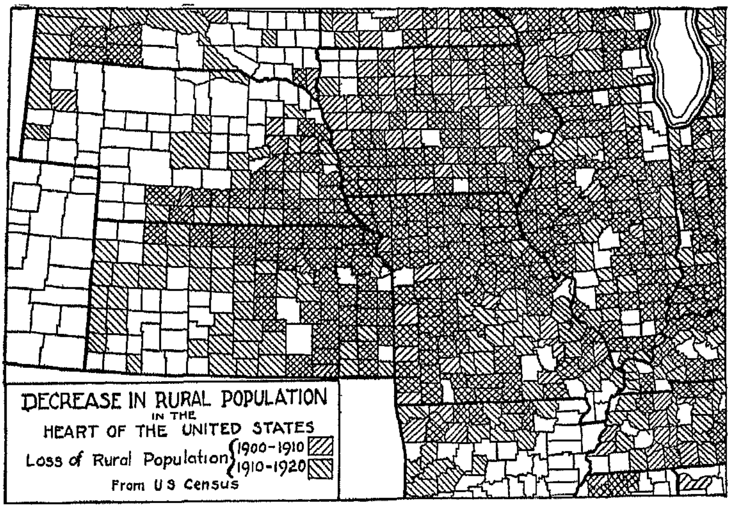


FIG 102 —Map showing the counties in five Corn Belt states that lost population between 1900 and 1920 This is in part a tribute to the efficiency of agricultural machinery and part to the cheap land of the farther West

Valley that was filling so rapidly in 1850 has for a time been emptying itself into other frontiers (Fig 102)

So rapid was the emigration to Canada before the World War that the young man of the corn belt was able to choose between taking up a free farm in Canada or working for high wages in Iowa. Thus farm laborers in the northern Mississippi Valley near to free land got nearly twice as much wages as those in the valley of the Potomac, where there was no free land Owing to this chance to get land it is plain that the factory that succeeded in getting workmen had to pay high wages to make them stay,

and for that reason American wages became and have remained high. Because of these high farm wages, manufacturers have made small progress in the upper Mississippi Valley, and only by relatively high wages could the laborers be kept in the East

New resources have the same effect as new land. The effect upon wages and industry of abundant natural resources and especially of newly discovered or newly utilized resources, has been sharply illustrated many times in the settlement of this continent When gold was first discovered in California, there was an enormous rush of miners from every state of the Union and every country of the world to dig up this gold from the sands of the California rivers where a man could sometimes find $10 or $15 in gold per day. This was often too strong a temptation for the sailors on the incoming ships, and large numbers of them deserted At one time there were 100 idle ships lying in San Francisco Bay because the crews had been tempted away by the higher returns to be secured by working for themselves in the gold diggings

At Cape Nome, Alaska, on the shore of the Arctic Sea, report of gold discovery about the beginning of this century brought a rush of thousands of men who when they got there strove for the chance to work for $3 a day in the few claims that made up the one gold-yielding creek. Others gladly worked for their board. Suddenly it was discovered that the sands of the seashore were full of gold where each man could wash out $10 worth per day, and that sum promptly became the rate of wages in all the settlement

The opposite influence has been lately shown in southern California, whither thousands of people have gone from the East to benefit their health, or for pleasure, in the gentle climate of the south Pacific coast with its warm and even-tempered winters and dry summers. The sudden influx of persons attracted by the search for health rather than by resources has caused many occupations to become overcrowded Salaries, therefore, have become surprisingly low in comparison with the general level in the western country

Ease of living in a sparsely peopled area and its influence on manufacture. Where population is scarce and climate favors vegetation, many things grow naturally and are to be had

for the taking—so-called free goods These conditions prevail to a greater or less extent throughout many parts of the United States, but especially south of Pennsylvania and the Ohio and Missouri Rivers and west to the limit of the eastern forest area This whole region was originally forest covered, and more than half of it is still covered by some kind of forest growth. Logs and timber are still abundant for house building, and the winter, milder than that of the north, permits a cheap house to suffice The same climatic conditions make less demand for fuel, and this the abundant woods still furnish in most rural communities.

It is in the matter of foods that the free goods are most abundant and most helpful in cheap living From the Rio Grande to the Delaware Bay the first bright days of spring bring a run of fish upward from the sea in thousands of creeks and rivers (see chapter on Fisheries), and in these regions a man can procure fish as surely by sitting on the stream bank and catching them as he can by sending to a city market and paying money for them. The herrings which can at this season be caught in nets by the millions are sold so cheaply that a few dollars will buy enough to fill a barrel and supply a family with salt fish for the rest of the year Before the frosts are over various wild spring greens duplicate the spinach and lettuce of the city market The family cow, giving from 4 to 12 quarts of milk per day and pasturing at from $1 to $2 per month, is a cheaper source of supply than milk served in cities and costing from ten to fifteen cents per quart. In May and June, wild strawberries are to be had for the picking, as are also the black heart and red heart cherries (Fig 103). These cherries grow naturally and bear plentifully along the roadsides, fence rows, and open woods from Pennsylvania southward. After the strawberries and cherries come raspberries, and the raspberry season merges into the blackberry season. The blackberry season merges into that of the huckleberry These berries grow in such abundance in swamps and on mountain sides that, like the cherries and other berries, they usually have no sale value whatever until they are picked After huckleberries come peaches, which, like the cherries, grow wild along the fence rows in some localities. In autumn comes the persimmon, sweetened by freezing, to hang upon the trees all winter waiting to be eaten,

and the black walnut, rivaling in nutrition the high-priced English walnut (Persian walnut), is so common that it often lies ungathered on the ground With the first frost the chestnut burrs are opened and this sweet nut is not only an important

FIG 103 —Mazzard cherry tree on campus of Swarthmore College This variety, often very productive, grows wild in much of the East and South, and the fruit is so abundant that anyone may pick all he desires—free goods

food supply, but also becomes a money crop of no mean importance in southern Appalachia. The people roam at will through the woods gathering chestnuts for shipment to the cities of the northern and central part of the country

As for the meat supply, in late August and September the young squirrels are full grown, and a good hunter can at times get five or ten in a morning. Colored men in the South sometimes report a catch of sixty oppossums in a single autumn, thus getting a meat supply which is quite as abundant as could have been bought with the wages earned by arduously working on a trolley track on a noisy street. With the falling leaves the oak

FIG 104 —French roadside No free goods Wheat comes clear to the gutter The trees along the road are grafted English (Persian) walnuts A good tree rents for as much as an acre of land In the distance at the left grafted chestnut trees line the fence rows

trees shower down their acorns, the natural food of the hog Often allowed to run at large in the forests, by December these hogs are fat enough to slaughter for the year's supply of ham and bacon

In addition to these free offerings of nature there is a garden by almost every house in the country districts and small towns of this part of the United States, so that the working man in

this region has two alternatives He may work regularly, get wages and buy food or he may work occasionally at the spasmodic labor of the farm and get an equal amount of food by going hunting, fishing, or berrying—facts of profound influence in checking the development of manufacture

The exacting demands of manufacturing. Manufactured goods are produced in a factory that should start Monday morning at the sound of the whistle and work on a schedule until Saturday afternoon This is an exacting demand upon labor.

FIG 105 —Corsican mountain side as steep as a house roof. No free goods as in America Every tree is a grafted chestnut and the crop makes the land worth $200 per acre

Throughout the sparsely peopled districts, with the abundant free goods above mentioned, labor is apt to be not only scarce, but unreliable, for most of the laboring population think they are just as well off if they occasionally stop work and go fishing or berrying or hunting, and when the desire comes, off they go, to the profound exasperation of millions who would like to employ them and cannot.

These conditions help to explain the absence of large manufacturing industries in these territories, which, in the manufacturing resources of food, raw materials, power, and natural ease of transport, are superior to those of busy New England.

In the colder North nature demands more of man. On the treeless prairies of the Mississippi Valley, there is no free house material, no free fuel, the fertile level prairie is all cultivated, and man must depend more upon his own efforts than is necessary in the South. This is one of the reasons why manufacture has developed more in northern than in southern states

The European labor supply. The chief difference between the life of the people in America and in Europe is explained by the factors already mentioned in this chapter—resources Hence conservation is one of the most vital and most patriotic movements in America. In Europe the result of density of population is clearly marked. In the United States the average population is 36 per square mile, in Germany it is 311, in Holland, 536 and in Belgium, 658, or more than one person to each acre. It is a region of little land per man He who eats the product of the land must either produce it with much labor or buy it Food prices are high because there is little land on which to produce, and wages are low because people are plenty Under these conditions people must work, and work regularly, and the great difficulty is to get a chance to labor Thus the factories can get an abundance of laborers cheaply, and northwestern Europe with its dense population is a veritable hive of manufacturing industries, as well as an area where the land is tilled much more carefully than it is in the United States. These points of difference between Europe and America serve to explain nearly all the great emigration movements of all times, and one who would understand manufacturing industries must have clearly in mind these vital and underlying facts

QUESTIONS

1 Would it stimulate or retard manufactures in England if 100,000 square miles of adjacent sea bottom suddenly became farm land? Why?

2 How does the speed of settlement of the United States show the service of coal?

3 Can a manufacturer produce cotton cloth more cheaply in a rich country than in a poor one?

4 Why are wages lower in populous Sicily than in sparsely peopled Canada?

5 Is the large amount of free food to be found in North Carolina an aid to manufacture?

CHAPTER VIII

FUNDAMENTALS OF MANUFACTURE

B BASIC METALS

Manufacturing depends on iron and steel. The abundance of these metals is rightly regarded as a sign of national wealth Iron and steel are especially important in the manufacturing industries Without their extensive use no nation can develop great manufactures

Iron, the most useful, is also one of the most universal of metals Man has found it in many parts of the world and used it since before the dawn of history, but we have of late turned to the earth's stores of iron with renewed eagerness and within a few decades increased our use of it many fold.

Our ever-increasing list of manufactures is almost universally produced by machines of iron and steel, while the same material is entering in increasing quantities as a raw material for the equipment of factories, farms, and homes, and all kinds of industrial equipment (Fig 109) Iron was an industrial luxury a century ago Now it is an industrial commonplace, since improvements in production have reduced the cost and permitted a great increase in production.

Coal is the twin of iron in the production of the new world commerce, because this commerce is carried in vehicles made chiefly of iron, driven by power derived chiefly from coal Coal also furnishes heat for the reduction of iron, and power for driving the machinery employed in its manufacture.

The formation of iron ores. Iron ores are plentiful, but the metal is never found even in a reasonably pure state except in recently fallen meteorities. It is dissolved from almost every hillside by the leaching rain waters, and where a stream of water with iron in solution enters a stream of water with lime in solution, iron ore is deposited For this reason we have a string of iron deposits in the United States from northern Ver-

mont to central Alabama These deposits are scattered along the edges of the limestones which are so common throughout this whole belt of Appalachian Valleys, especially in the Great Valley from Lebanon, Pennsylvania, to Birmingham, Ala , which has many deposits of limestone throughout its extent. Where the conditions suitable for the deposit of iron ore continue undisturbed for great periods of time, we have large deposits, veritable mountains of ore, such as exist in the rough country south and west of Lake Superior, in the iron mountains of Mexico, the mountains near Santiago, Cuba, near the Cantabrians of northern Spain, in northern Sweden, Brazil, and in many other parts of the world

Iron is melted out of the ore by being put into a huge stack or furnace sometimes 100 feet high and filled from bottom to top with roaring fire that rushes upward through layers of coke, ore and limestone The draft is provided by a blast of air driven by pumping engines (Fig. 106) Hence the name blast furnace The limestone makes it melt at a lower temperature and unites with the dross to form slag or cinder which is much like lava The iron being heavier collects in the bottom and is drawn off at intervals of a few hours The slag is drawn off at a higher opening and is now often used as a raw material for cement

Iron making in America. The United States is the leader in iron making in the twentieth century, as was England during the nineteenth century This leadership has come as the result of a number of rapid transformations of the industry in this country In George Washington's time the little forges or small blast furnaces with a draft forced by a water wheel were scattered from New England to Georgia and from the seacoast to the Appalachian Valleys in what now seem to be remote and isolated locations Iron was made wherever the local blacksmiths needed it, and a small ore bank, a waterfall, and the American forest, almost universal in the East, furnished the necessary raw materials, which the farmers hauled at odd times.

Fortunately for the American iron industry, the first coal field to be developed was the anthracite, which, by its purity and hardness, served well for smelting purposes without being made into coke. Here was a factor that gave one region a heavy advantage over all others and after 1840 we had a rapid con-

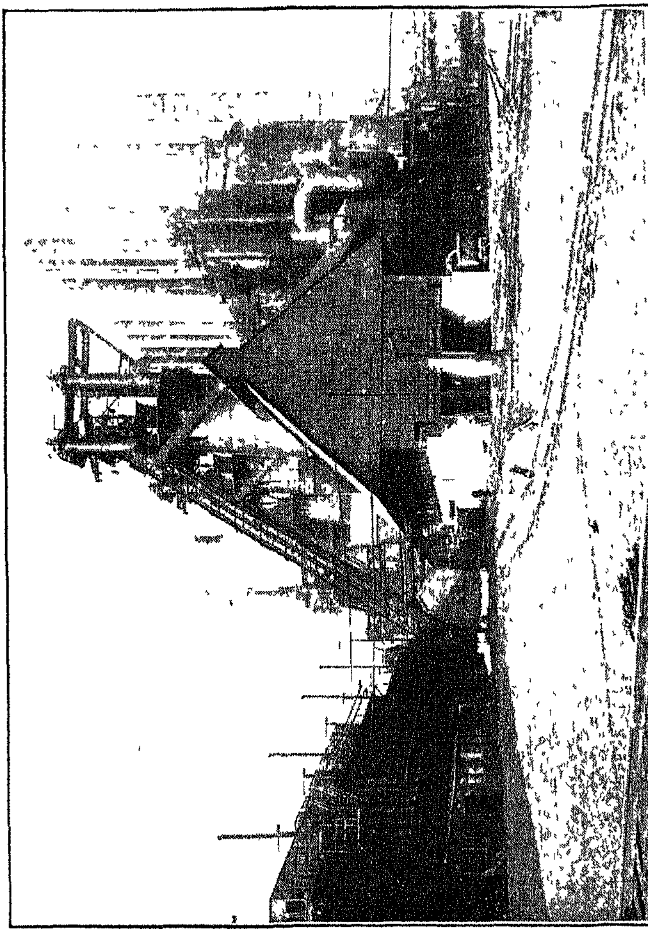


FIG. 106 —A Blast Furnace Ore bins and freight cars at left, skip hoists (inclined planes) going up to furnaces in center, white hot molten metal running into ladle cars at both sides of furnace At the right are the stoves which heat the blast so that the furnace is fed by heated air (Bethlehem Steel Co)

sible at any point on the shores of the lakes from Buffalo to Chicago. Manufacture under such conditions requires one less handling of the ore than is necessary at an inland point like Pittsburgh, or Youngstown (Ohio). This was an important factor in causing the United States Steel Corporation to locate at Gary, Ind., on the lake shore near Chicago, the largest and most complete steel plant in the world This plant is also close to Chicago which is in itself a large iron market.

In northern Alabama, Birmingham, named from the iron city of England, possesses iron-making facilities that permit lower costs of production than at any other place in America, for here are found in the same district (see Fig 118, Map of Birmingham District), within very short hauls of one another, the necessary

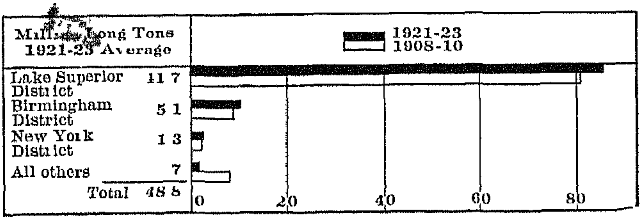


Fig 107 —United States iron ore production, three-year average

ore, coal, and limestone, while fairly good transportation facilities place the district within easy reach of the rapidly developing southern markets for iron and steel products For these reasons the Birmingham district ranks high in the value and importance of its putput, and is a leading factor in the industrial development of the South.

Several minor producing districts exist in the United States At the head of Lake Superior, near Duluth, iron plants have arisen to supply the northwestern market They use the local ores and coal brought chiefly from Pennsylvania, because the vessels that have carried ore eastward to the Pennsylvania furnaces would otherwise usually have to return to the ore docks empty Some iron is made of local ores and western Pennsylvania coke on the shores of Lake Champlain, in northern New Jersey, and in eastern Pennsylvania, as at Bethlehem, Lebanon, and Steelton. The eastern Pennsylvania plants are mixing local

ores with some from Lake Superior and from foreign countries The importation of ores into Atlantic ports indicates a revival of eastern iron making. Despite our great riches in iron ore there is an advantage in iron quality resulting from mixing ores There are many qualities desired in iron, and various mixtures of ore make it possible to produce them easily. Our chief ore import is from the district of Santiago, Cuba, controlled by American interests, to the ports of Baltimore, New York, and Philadelphia, while lesser quantities are brought from Newfoundland, from Sweden, from Spain, from the island of Elba in the Mediterranean, and scattering cargoes from the coasts of the Black Sea, South Africa, and South America. Americans have purchased and begun to develop valuable ore lands in Chile.

In Colorado, which has local coal and ore, there is another new iron center, which, being a thousand miles from any other iron-producing district, is of great importance in the Rocky Mountain region, but the output is as yet only about 1 per cent of the total product of the country

The Pacific Coast, with its scarcity of fuel, high wages, and convenient access to water-borne cargoes of structural iron from eastern plants, has developed only a very small iron-smelting industry Its shipyards and foundries import most of their material from the eastern states and from Europe, a process that is made easier since the opening of the Panama Canal in 1914.

The Lake Superior iron ore fields produce far more than any other because of the great size of the deposits, their richness, and the ease with which they can be mined Many of the ore beds are so near the surface that they can be taken from open pits, and so pure that they can be scooped up with steam shovels and loaded on freight cars according to the method followed in digging railroad cuts It is never lifted by human muscle or touched by human hand until it is finished iron or steel. "Up by steam and down by gravity" is the motto. The ore car runs out onto a high dock, drops the ore through its bottom into ore pockets, thence it drops into the steamer alongside to be lifted out by clam-shell buckets working like human hands but lifting tons at a grab.

Steel making. Steel is merely a kind of iron which is hardened by an admixture of definite amounts of alloys, mostly

carbon. There are several processes of making it. The oldest process called cementation begins by putting cast iron into a puddling furnace, which is a sort of basin with flames beating over it. The puddler stirs the molten iron in the basin with a rake while the flames burn the carbon out of the iron. When the coarse carbon of the cast iron is nearly all burned out, the iron, then called wrought iron, is very tough, malleable, and ductile. In the cementation process the wrought iron bars are packed in air-tight boxes with charcoal (carbon) and the whole box kept red hot for a few days, during which the carbon is slowly absorbed by the iron. The product, called "blister" steel, has great hardness but lacks uniformity, as the carbon varies from the surface of a bar to the center.

Fine steel was first made by a watchmaker of Sheffield, England, in search of better material for his watch springs. By melting the bars of blister steel in clay pots he obtained the desired uniformity. This method developed into the crucible process, where wrought iron is melted in a clay pot and powdered charcoal or some other form of carbon is put directly in the molten iron. The famous Sheffield tool steel is still made by the crucible process, and is used for fine cutlery, firearms, and instruments of precision.

But the railway and the steamship require a cheaper metal. The great development of world commerce could not begin until after the invention, in 1860, by an Englishman, Sir Henry Bessemer, of the so-called Bessemer process. By this process 20 tons of steel are made in a few minutes by putting molten iron into a large retort through which a current of air is blown violently. The oxygen of the air unites with the carbon in the iron and burns it out. The product is then virtually wrought iron, which is changed to steel by the addition of the proper amount of carbon in the form of high carbon iron called "spiegel-eisen." This quick method makes the cost of Bessemer steel but a small fraction of that of making crucible steel, and so for the 60 years since its invention, Bessemer steel has been of great service in making rails for railway tracks, and steel girders for bridges, elevated railways, and the skeletons of tall office buildings.

Bessemer steel, however, sometimes breaks without warning and the great weight of the present-day locomotive requires a

better rail than can be made by the Bessemer process This new demand is met by a newer, slightly more expensive metal called open-hearth steel. This is made by putting molten iron in a basin over which flames from a gas-fed fire beat for 8 or 10 hours or until the carbon content is reduced to just the right amount, which can be determined by testing. This stronger, more uniform, and more reliable open-hearth steel is used for boiler plates, ship plates, and the best steel rails now used, and is rapidly displacing Bessemer steel This open-hearth process, enabling the removal of the phosphorus impurity which occurs in many of the Birmingham ores, has greatly aided that district in taking a prominent place in the American steel industry Open-hearth steel gained the ascendency over Bessemer because the furnaces can be accurately controlled, to meet the scientific needs of modern industry.

Finally electric steel appeared, first manufactured in Europe where hydro-electric power is abundant, then made in America in 1908 The electric furnace can be regulated even more minutely than the open hearth. Because of that fact electric steel is in a fair way to displace crucible and, although still higher in price, is beginning to compete on a tonnage basis with straight open-hearth and Bessemer Electric furnaces in the United States have increased from 19 in 1913 to 406 in 1923 The electric furnace is especially adapted to the making of various steels using alloys other than carbon, which are produced for special purposes, as nickel steel for armor plate, vanadium steel for automobiles, chrome and tungsten steel for the cutting parts of machine tools. Through this superior cutting quality a few hundred tons of tool steel have multiplied several fold the efficiency of thousands of machines and machinists Thus its importance in industry is almost beyond calculation.

Iron as a world industry. Extensive iron making is an industry of countries advanced in manufacturing. It requires excellent transportation facilities, many laborers, much capital to build and operate the enormous plants, and the large market which only a vast population can give. It very distinctly is *not* a frontier industry, and this is just as true in the new states of the United States as it is in Australasia or South America. As a result, six countries dominated the iron making of the world in

1913 and three of these were of distinctly minor importance (Fig 108) The United States, Great Britain, and Germany made three-fourths of the world's pre-war supply, Russia, France, and Belgium were the next group, and after they were named, there was little left of the world's iron industry. The World War increased iron making, especially in the United States, but the post-war stagnation of industry caused a still greater slump, far below the 1913 figures. Russia has nearly ceased production for a time; the only increase has been in Japan, which does not yet make sufficient iron for her own needs. South America, Africa, Asia, Australia, the East Indies, all the islands of the sea,

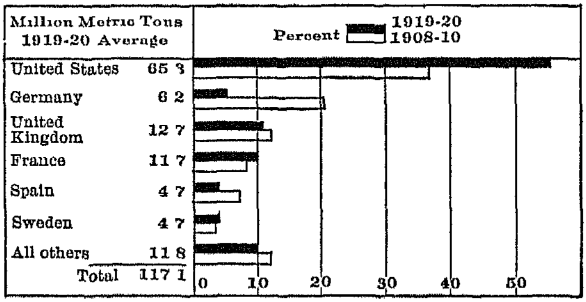


FIG. 108 —World iron-ore production, two-year average.

and all the countries of the Mediterranean do not together make as much iron as a single Pittsburgh company, though nearly all of these countries have large quantities of ore.

World commerce in iron. While the large production of iron is localized in a few districts of eastern America and western Europe, its commerce is world wide. All peoples who trade use it in many forms, so that from England, Germany, France, the United States, and Japan the manufactured products go to every country. The European countries, with their older industries and their cheaper labor, produce the more highly manufactured forms such as cutlery, tools, instruments, and the finest machinery From the United States, which excels in raw materials and labor-saving machinery, the heavier products are shipped, such as railroad rails, bridges, girders, plates, and pipe. Pittsburgh rails and bridges are to be found upon the railways of Mexico,

and Manchuria, on the upper Nile at Khartum, upon the African lakes in Uganda, in Australia, in Japan, and in Ecuador. The steel mills of Europe and America will continue for many decades to equip the new countries of the world.

The future of the iron industry. Despite the many shiftings of the iron industry it has as yet used but a small fraction of the total ore-supply. The amount of ore throughout the world is very great, some of it being of good quality, but much the greater quantity is of relatively low grade such as we have not as yet learned to use because we have not as yet been com-

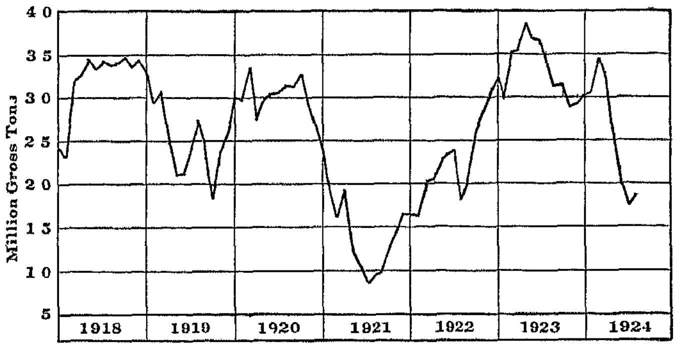


FIG 109—Production of pig iron in the United States The iron industry is called the Industrial Barometer. What is the percentage of variation?

pelled to do so The iron industry, being comparatively young, has thus far drawn only upon the best ores.

Ocean steamers now render such cheap service that the ores near the coast of distant lands such as Central America, Brazil, South Africa, and Sweden are in terms of freight rate much nearer to the furnaces of Pittsburgh or Baltimore than are the ores of Colorado. Thus the Sparrows Point smelters of Baltimore bring most of their ore from Cuba, although the Lake Superior mines are only two-thirds as far away, but over a more costly transportation route This condition makes a world supply of iron ore and indicates that the increasing American import of Swedish and Spanish ores is not an exception but part of a world movement The United States Steel Corporation has purchased the famous iron mountain of Durango, Mexico, said

to contain 300 million tons of iron Six thousand miles by steamer and 1,000 miles by rail is not an over-expensive haul, and it is one that will make nearly all the earth accessible to one or the other of the great manufacturing regions of the future—the Orient or the North Atlantic

The electric smelting of iron ore has long been experimented with and has reached a profitable stage in Scandinavia where abundant water-power is available for cheaply generating the powerful current It is calculated that ores of only 40 per cent purity can be utilized by the electric method This possible emancipation of iron making from a fuel supply is a matter of great significance The Norwegians make a ton of iron per year for one horse-power of electric energy

Copper and aluminum. These metals are rapidly increasing in importance because of the many new uses to which invention subjects them. Bronze, an alloy composed of copper and tin, is a most durable metal prized alike by prehistoric and by modern man A mixture of copper with zinc makes brass, but it is electricity and electrical manufactures which have made us so suddenly dependent upon these rarer metals. Fortunately we have increased our ability to get them

Machines, power, explosives, chemical processes, and the large corporation have, within 50 years, transformed the winning of the less abundant metals to an extent comparable to the changes in the making of textiles In some kinds of mining, operations are on a gigantic scale and the miner is no more of an industrial unit than the weaver. A recent mining enterprise in Nevada expended $20,000,000 in the purchase and equipment of two mines including 141 miles of railroad, a smelter, three towns, and a concentration plant to get copper, gold, and silver from a low-grade porphyry ore.

The production of copper has approximately doubled since 1900, the total world production now being about 1 million tons a year (Fig 110) This increase in copper production is in response partly to the universal demand for copper in electrical work and partly to our ability to use low-grade ore due to the very rapid improvement in mechanical devices, and processes for the extraction of the metal. This source of increased supply is shown by the newly won ability to use large deposits of por-

phyry ores in Nevada, Arizona, Utah, and Queensland, but which were of no value at all a few years ago Constant discoveries of copper ore and new methods of smelting assure sufficient supplies for the immediate future, but some well-informed persons expect

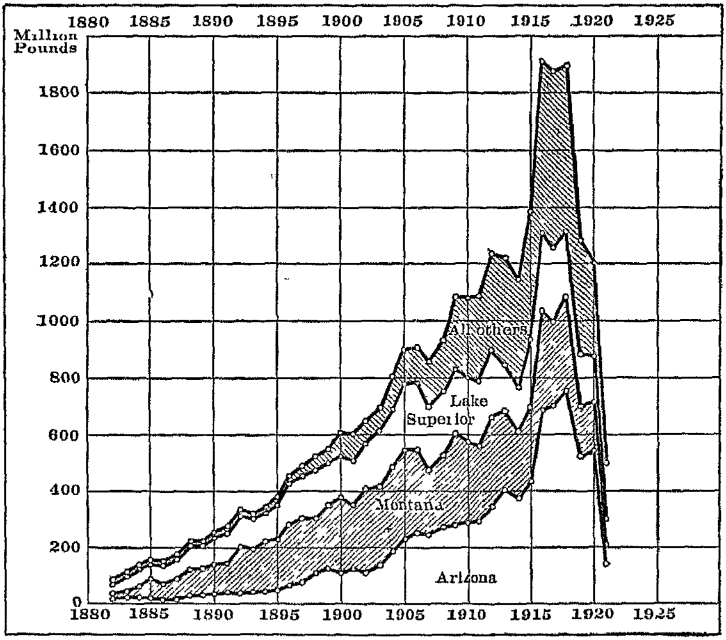


FIG 110—The production of copper in the United States What effect does war have on the demand for copper?

scarcity to begin in 15 or 20 years This period of the new discoveries is the golden age of metals

The occurrence of copper. Copper occurs in nature both as a metal and as an ore It usually occurs in combination with many other substances A single copper mine in Utah, for example, contains silver, gold, and iron, while a Montana copper company (the Anaconda) is the largest producer of silver in America Other mines, especially in Colorado, have the copper in combination with silver and lead Sulphur is one of the commonest substances with which copper occurs, and it is usually

driven off by roasting the ore, which causes the sulphur to unite with oxygen of the air in the fire and pass off as sulphurous gases very injurious to the comfort of the people living in the vicinity, and destructive to the vegetation for miles around, as at Butte, Montana The sulphur of these furnaces can be made into sulphuric acid at a cost as low as 58 cents per ton, and one of the largest Montana copper companies is building concentrating plants for the production of acid to use in the manufacture of fertilizer from phosphate rock, two tons of acid being

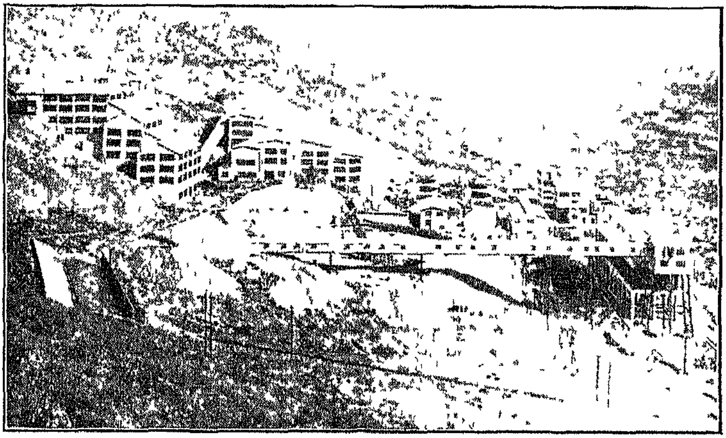


FIG 111 —Copper concentration plant at Bisbee, Arizona Such a plant is often but a small part of the equipment necessary before a ton of the red metal can be sold (Phelps-Dodge Corporation)

required in the treatment of one ton of rock. Thus a noisome gas may be utilized in a valuable by-product industry. (Min Ind. 1922, p. 656.)

The upper portion of Michigan was for many years the leading copper producer of the United States and of the world. In the old rocks of this glaciated district, there exists a large copper deposit, unusual in that some of it is pure. Here the copper occurs in nuggets, often of great size, and in small grains, scattered through the rocks, which have to be crushed to release the metal Easy transportation to this region by the Great Lakes caused early and profitable development of mining. Some of the

mines are now almost a mile deep and their productivity is declining

Due to the one great deposit in the hill at Butte, Montana has surpassed Michigan in output, to be in turn surpassed in 1910 by Arizona, on account of recently discovered deposits which now yield nearly half of the American output. This metal is much more valuable per capita to the sparse population of Arizona than is wheat in North Dakota or iron in Pennsylvania.

Nevada and Utah are apparently just beginning as important copper producers. Recently found Nevada deposits of the newly conquered porphyry ore can be mined by steam shovels as are some Lake Superior iron ores.

Arizona copper fields are continued in the adjacent Mexican State of Sonora, where mining progress has been rapid, making Mexico an important copper-producing country. Chile has become the second copper producer, but her output in 1922 was not quite one-third as great as that of the United States

The import of copper ores. In addition to being the greatest producer of copper, the United States also smelts a great deal of copper ore produced in foreign lands. This is due partly to our great wealth in the necessary coal and also to the fact that from many sections ships returning, practically empty, can carry the ore cheaply For these reasons, New York, Baltimore, Norfolk, and other coast cities smelt hundreds of thousands of tons of copper ore brought from Labrador, Newfoundland, Spain, Portuguese Africa, Chile, Peru, Cuba, and Canada. Although the metal is destined for export, our copper imports are nearly as great as the combined production of any two foreign countries.

Aluminum. Aluminum is the newest of the important metals. It is especially attractive because it conducts electricity, is light, tough, and non-corrosive, being strong in qualities in which iron is weak. As one of the six commonest elements of the earth's crust, it exists in enormous quantities in the ordinary clay. Hence, great hopes for the future are entertained, but the extraction of the element in its metallic form is very difficult. In 1880 the price was $10 per pound and the world's production only 2 or 3 tons per year. In 1907, as a result of new processes of manufacture, its price fell to 42 cents per pound, and in 1922 to 20 cents, and the production now exceeds 100,000 tons a year,

half of it made in the United States The manufacture is still costly. An aluminum plant at East St Louis requires 1 ton of bauxite (aluminum ore), 1 ton of coal and 1 ton of very pure limestone to make half a ton of alumina (an oxide of aluminum) This requires further treatment in the electric furnace, a process requiring a large amount of electricity, by present practice about 1 horse-power for a day to produce a pound of aluminum The world's aluminum is, therefore, made most easily where power is cheap, namely, the regions of great water-power Five companies working in Europe are located in the mountainous districts of Savoy, France (western Alps), of Germany, and of Italy. One of the American companies has plants at Niagara Falls, using 40,000 horse-power, others in Massena, New York (on the St. Lawrence), using 20,000 horse-power, and Shawinigan Falls, Canada, using 15,000 horse-power With the reduced price, come new demands For example, aluminum wire is a strong competitor of copper for high-tension power transmission lines. Automobile construction and aerial navigation have opened a new field for the lightest kind of strong construction, and the motor car has become the leading user of aluminum and its alloys. It is estimated that cars and trucks now average 100 pounds of aluminum each, at which rate the 4 million motor vehicles made in America in 1923 called for 400 million pounds With the increasing use of cars and the growing demand for light weight, strength, and beauty, the demand for aluminum seems likely to become still greater. New alloys are constantly discovered and each new alloy gives new uses. Since common clay is largely aluminum silicate there is the constant hope that some one may discover a way to give man access to these mountains of metal that look down upon us in every continent

Questions

1. How have inventions helped to concentrate and to scatter the iron industry? Give several examples
2 Is Pittsburgh a better place than Cleveland for a new iron plant?
3 Why was Gary, Indiana, chosen as the site for the largest steel plant in the world?
4 What has been the influence of new alloys of iron?
5 How does it happen that the United States with the largest iron production of any country is also an ore importer?

6 Why is it that we are greater smelters of foreign copper ores than is Great Britain?

7 Why is Butte, Montana, a good place to start a fertilizer industry?

8 What industries might be affected by the discovery of a cheaper process for making aluminum?

CHAPTER IX

THE FUNDAMENTALS OF MANUFACTURE

C POWER

I COAL

Importance of power to manufacturing. In the development of manufactures iron is important, but the possession of some source of mechanical power is a much more potent factor in deciding a nation's rôle in manufacturing and in civilization, for the iron can be imported much more easily than the coal which has thus far been our chief dependence for power. We de-

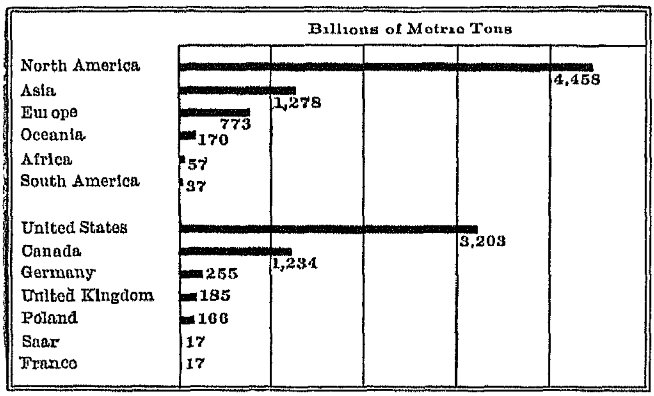


FIG. 112.—The coal reserves of the world by continents and selected areas

pend upon mechanical power in a way not unlike the dependence of young children upon their parents.

Our absolute dependence on coal. If some wizard should, upon the first moment of an incoming year, banish all coal from the world, instant darkness would settle over the streets in most of the world's great cities and their inhabitants would rise the

next morning to find their houses cold, and nearly all their factory wheels motionless. The starvation that immediately faced them would kill millions of people before another January first had come. Witness the plight of Belgium in the war, winter of 1914–15 (see appendix, table of food imports). England would be the worst sufferer, because coal-driven steamships and railroads bring to that country much of the food and raw materials upon which her people depend for sustenance and industry. There would be no escape from the panic-stricken island because the coal-driven steamships of the world would lie helpless, sailing vessels and oil burners would be grossly inadequate, and the building of more vessels would require iron and wood, neither of which could be had without the use of coal The people of Germany, Holland, and Belgium, New England, and New York City (this city alone uses over 15 million tons of coal a year) would be in nearly as bad a plight as those of England

World commerce is now coal-driven commerce, and world manufacture is carried on chiefly in the steam-driven factory. Coal is thus back of both factors which have enabled man in the nineteenth and twentieth centuries to separate so widely his home space from his sustenance space. All the modern nations have at their disposal mechanical power, chiefly coal driven, which far outranks the combined muscular force of all their men and all their beasts, and the increase in its use is very rapid (see table, appendix).

Late and rapid development of American coal mining. During the first two-thirds of the nineteenth century, while England was busy manufacturing with coal, the people of the United States were chiefly employed in settling and farming the free lands of the Mississippi Valley which the United States Government was giving away to settlers. Our manufacturing industries started, before the improvement of the steam engine, in New England, where many streams tumbling down from the highlands made abundant waterfalls and good water-power, as evidenced in the names of old New England mill towns, such as Fall River, Chicopee Falls, Rumford Falls, Bellows Falls, and many others. For domestic fuel the American people for two centuries burned wood, while England, old and relatively populous, had been short of forests in Queen Elizabeth's time and was using coal. In

1660 the British consumption was two-fifths of a ton per capita, a quantity not equaled in the United States until after 1850.

Coal mining in America was of slow growth. As late as 1820, Pennsylvania anthracite had a production of but a ton a day.

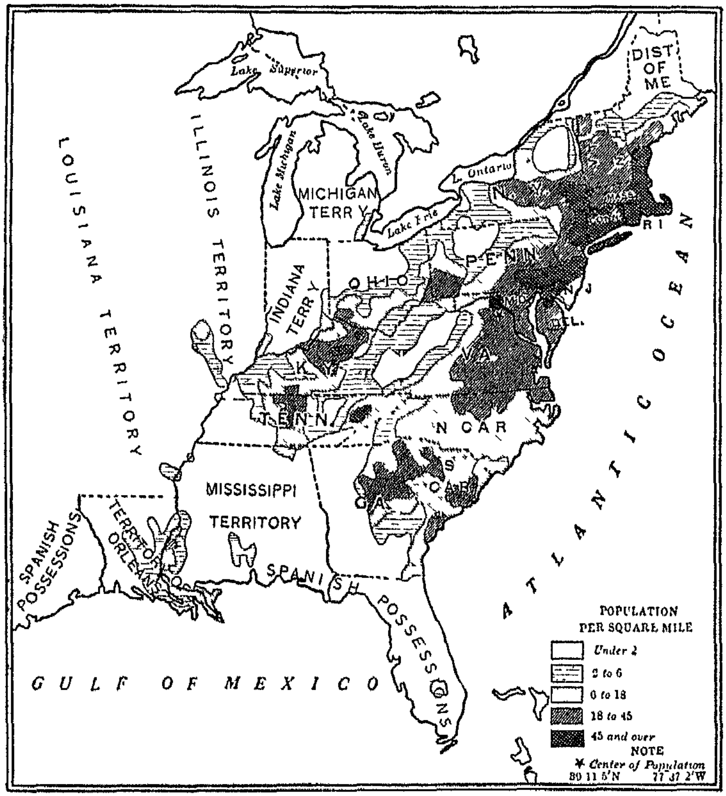


FIG. 113 —Distribution of population in the United States, 1810, before the age of railway transportation

But these deposits served as a magnet to attract the pioneers at both canal and railroad building, a highway of each type being built up the Schuylkill River from Philadelphia to the southern edge of the coal fields. Owing to the improvement in transpor-

tation facilities our coal consumption increased rapidly after 1850 The per capita consumption in 1850 was 0 287 ton, in 1870, 0.960 ton, in 1900, 3 530 tons, in 1910, 5.100 tons, in 1920, 6 1 tons, or over 33 pounds per day for every man, woman, and child in the United States (see Fig. 114).

The influence of coal on the settlement of America. It was coal and steam that enabled the American people to finish the

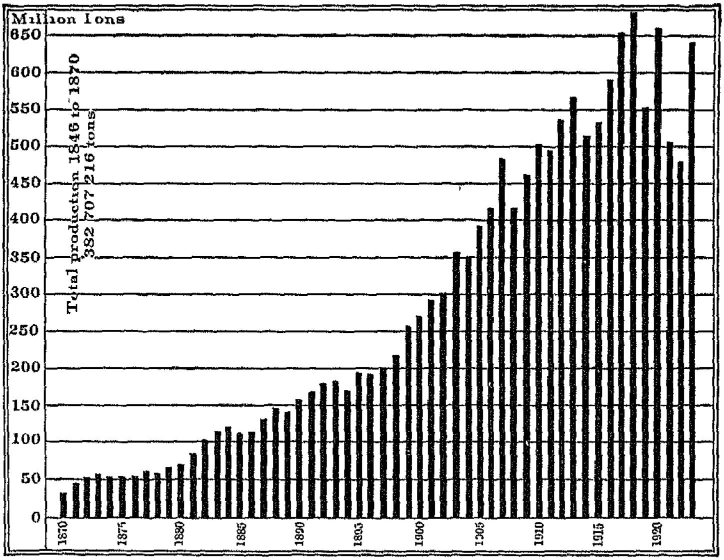


FIG 114 —Production of coal in United States 1846–1923, a rate of increase that cannot and should not be maintained

conquest of the American continent In the two centuries between the founding of Jamestown and the marketing of coal in Pennsylvania, the colonists had slowly struggled westward through the forests and mountains and settled the river districts of western Pennsylvania, Kentucky, and Ohio, but the conditions of transportation in the West were such that no populous commonwealth could arise (Fig 113). Exports of grain and meat and a little lumber went to New Orleans down the Ohio and Mississippi Rivers in flatboats, which were knocked to pieces because they could not be pushed up stream against the swift current.

Imports were brought in wagons over the Allegheny mountains to Pittsburgh and thence down stream to the points where they were consumed Economic and social progress was difficult under such conditions. In 1812 the steamboat changed all this by ascending the Mississippi River and making a two-sided commerce. It enabled American people emigrating in steamboats to attack the heart of the continent in a hundred places on the great navigable system of the Mississippi between Pittsburgh, Kansas City, Minneapolis, and up-stream points on many smaller

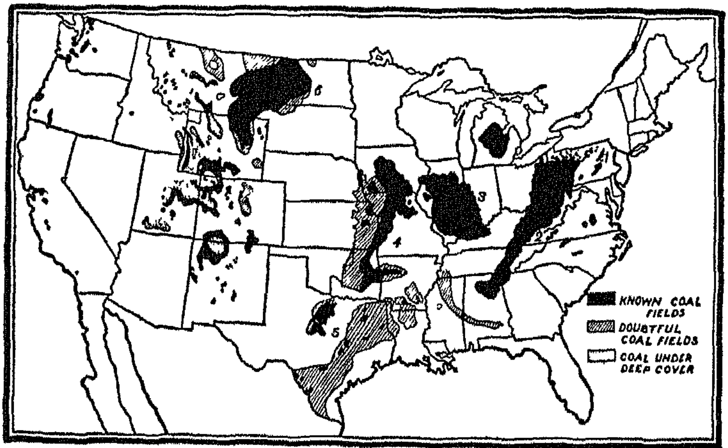


FIG. 115 —Map showing general distribution of coal fields in the United States. (United States Geol. Surv) (From Salisbury, Barrows, and Tower.)

rivers Two decades later the steam-driven locomotive broke the shackles that had for ages held civilized man by the river bank and seashore, so that in half a century the American people spread five times as far as they had in the two preceding centuries.

Pennsylvania anthracite. The first coal to be extensively developed was in the anthracite fields of eastern Pennsylvania (Fig. 115), which have the best coal in America In this region we have now an annual production of nearly 1 ton of this valuable coal per capita for all the population of the country. Thus the supply is being rapidly reduced. The scattering remnants

of a deposit once of much greater area are divided into three fields covering an area of but 475 square miles with the cities of Scranton, Wilkes-Barre, Pottsville, and Shamokin as the chief mining centers (Fig. 116).

The Appalachian bituminous coal field. The Appalachian coal field (Fig 115), reaching almost without a break from northern Pennsylvania into northern Alabama, contains the finest bituminous coal lands anywhere in the world. The coal area in western Pennsylvania alone is larger than Massachusetts,

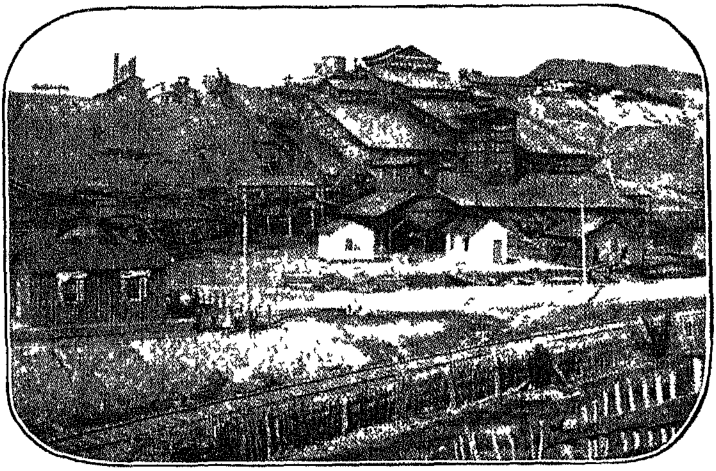


FIG 116 —A large building is required to prepare anthracite coal for market and the earth is encumbered with refuse Eastern Pennsylvania

Rhode Island, and Delaware combined Ohio River navigation opened this rich fuel deposit to the world and caused many new towns to spring up in the wilderness to shelter the miners. Pittsburgh, standing where the navigable Ohio was formed by two navigable branches, was the most convenient point of access to this coal field and the natural place for its earliest development Each year acres and acres of barges of Pennsylvania coal float down the Allegheny, the Monongahela, the Ohio, and the Mississippi, carrying millions of tons to Pittsburgh, Cincinnati, New Orleans and other cities along the great waterway.

The central part of this Appalachian coal field in West Virginia, eastern Kentucky, Tennessee and part of Virginia was not developed so early because it was more difficult of access, but many mines were opened there in the decade after 1915. At the present time there are in eastern Kentucky 10,000 square miles of this Allegheny plateau underlaid with coal. But this plateau has been carved by its many streams into a succession of steep

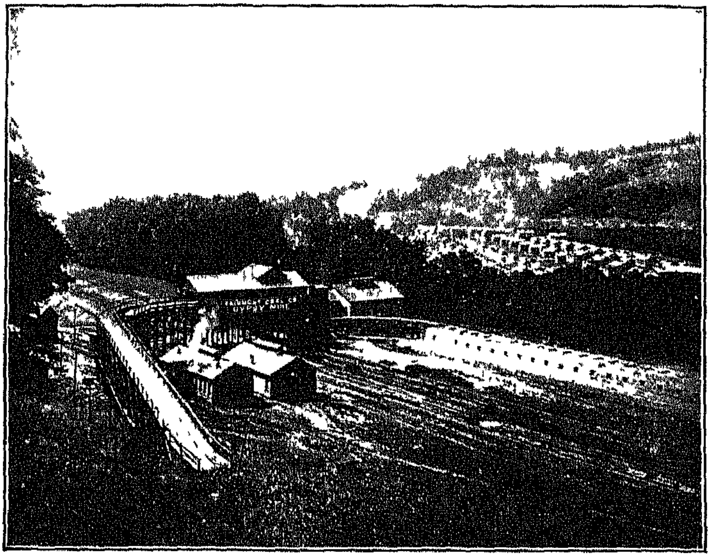


FIG 117.—Coal tipple, beehive coke ovens (right center) and miners' village in bituminous field, West Virginia (Philadelphia Museum)

mountains and sharp gorges, which are so difficult to travel that there is no railroad, and therefore no commercial coal mining The people of some localities thus isolated are living the life of the pioneers and backwoodsmen of the Revolutionary period.

No more striking illustrations of the dependence of economic welfare upon transportation facilities can well be found than the contrast between the poverty and ignorance of these isolated mountain people and the prosperity and commerce of their kinsmen and neighbors upon the lowlands beyond the mountains.

West Virginia, not so inaccessible as Kentucky, but far less

accessible than the Pittsburgh district, has now become a great coal producer The West Virginia coal fields are difficult for railroads to cross and the valleys are so narrow that the houses of the mining towns are perched row after row upon the steep slopes that rise directly from the streams (Fig 117)

The southernmost of these eastern coal fields is in Alabama near Birmingham (Fig. 118). It is very accessible to adjacent markets and hence has greater development than any field south of West Virginia. The recent building of locks and dams in the

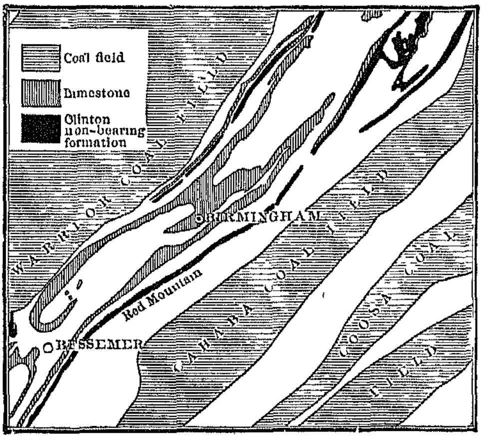


FIG 118 —Birmingham District, Alabama, showing a relation of iron ore, coal, and limestone which permits the cheapest iron manufacture in the world (Map after Bigham)

Warrior River, which permits the carriage of this coal in boats to Mobile and New Orleans for the supply of steamships and for export to Gulf and Caribbean ports, greatly increases the opportunity of this district for profitable development.

Pennsylvania bituminous coal was worth about $5 00 per ton at New York harbor in 1924, and Virginia Pocahontas (used by the United States Navy because it is one of the best steam coals in the world) was $4 25 per ton at Hampton Roads Atlantic coast cities thus have a relatively cheap fuel supply in the Virginia coal brought to tidewater by the Virginian railway and taken to New England by boat from Hampton Roads for eighty

cents per ton in competition with coal taken by boat from Philadelphia and New York or taken by all rail-shipments

The interior coal fields of America. The eastern interior field (see Figs. 115 and 119), southern Illinois, southern Indiana and western Kentucky, is second in importance only to that at the headwaters of the Ohio The coal (bituminous) is not of as good quality as that of the Appalachian fields, but it is better than most of the coal of Europe, and its nearness to Chicago, St. Louis, and the many manufacturing centers of the North

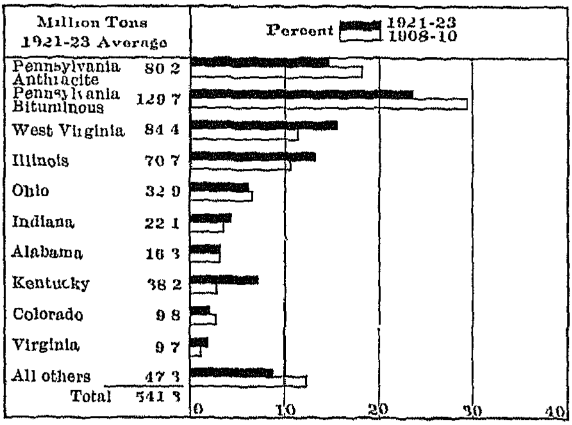


FIG. 119 —United States coal production by states, three-year average

Central States makes it the chief dependence of those regions and the output is greater than that of Pennsylvania anthracite

It is an interesting fact that the quality of American coal declines as we go west until the Rocky Mountains are reached. The large western interior and southwestern fields, extending from central Iowa to central Texas, are inferior to those of Illinois and Indiana and are not so extensively mined. Beyond these the yet inferior coal that underlies vast areas of the plains of Dakota, Montana, and Wyoming is mined only for local use. Most of it is lignite like the coal of Germany

In taking any long view of our resources we should count the low-grade coals at a higher valuation than to-day's market gives them. *They have energy in them* and we can depend upon science

to get it out when needed. The Rocky Mountains, embracing with their adjacent plateaus almost one-fourth of the United States, are a region of such sparse population and vast extent that their resources are not fully explored Each year the scientists of the Geological Survey find thousands of square miles of additional coal, and it is already known to exist in every state from New Mexico to the Canadian boundary (Fig. 120). The

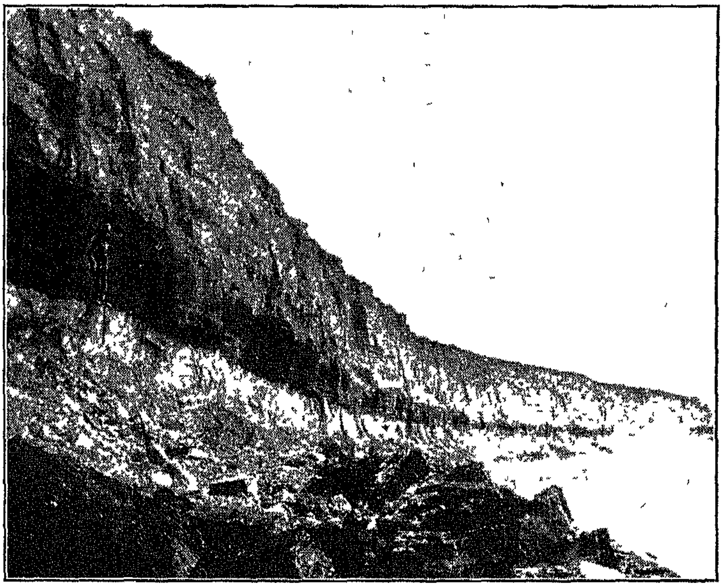


FIG 120 —Man standing in front of coal seam outcrop in banks of Yellowstone River, Montana. Blocks of fallen coal in foreground In some parts of the West, farmers go to such banks and load their wagons (Campbell, United States Geol Surv.) Man is ½ inch from left margin of picture.

total quantity is doubtless very great and some of it is anthracite of good quality. Much of this western coal land still belongs to the United States Government, and should be held as a reserve for the future needs of the nation. It is hoped that it will make comfort for all people rather than colossal fortunes for a few and misery for many It can be leased to mining companies by the government quite as easily and more satisfactorily than

the present practice of leasing coal lands by individuals to mining companies

The Pacific Coast and Alaska. The Pacific Coast is the only part of the United States which suffers from lack of coal For this reason the development of manufactures was greatly hampered in California, until the discovery of petroleum in large quantities in 1901 ended this fuel scarcity for a time

Our incomplete knowledge of Alaska is being rapidly extended, and one of the surprises of this erstwhile little-esteemed region is its valuable deposits of coal and copper The Alaska coal field opened up by a new government railroad and first extensively mined in 1918 with an initial output of 76,000 tons, is too inaccessible to be used rapidly, but is likely to prove a boon to future generations

American commerce in coal. Despite our enormous coal sources and world-surpassing production, the coal export of the United States is relatively insignificant, because the coal-carrying vessels can get no return cargoes Nearly all of it goes to Canada, but small amounts are sent to Italy, Mexico, Argentina, Brazil, Cuba, and the West Indies. Regular lines of vessels have long carried coal from Norfolk to Tampico for the supply of the Mexican railroads and mines. In times of European war and coal strikes we have temporary coal exports of large volume

The small export should not for an instant cause one to lose sight of the enormous part that coal plays in American railroad traffic. The entire wheat crop of the United States does not weigh half as much as the coal produced in Illinois or West Virginia. The entire cotton crop of the United States only weighs a quarter as much as the coal product of Alabama and only an eighth as much as the coal imports of New England

Most of the present transportation of coal is entirely unnecessary. Central power plants at the mine mouth could generate power quite as cheaply as in more expensive town locations. Experience has shown that power can be transmitted over 200 miles in the form of electricity, at a very low cost. Most of the people and most of the cities of the United States are now within that distance of coal mines. We need transmission wires and gas mains to replace freight trains, thus saving much unnecessary and expensive handling, as well as the fuel used by the engines

now hauling the needless coal trains The chief barrier is conservatism. Technique has been ready for years.

America, the richest nation. The coal resources of the United States are much greater than those of Europe Coal underlies nearly one-sixth of the area of this entire country, over 400,000 square miles, Russia has only 20,000 square miles and the United Kingdom but 11,900 Germany, with less than 2,000 square miles, was, next to England, the greatest European producer, before the World War, because Germany has within the last 40 years had an enormous development of manufacturing that requires coal Part of the former German coal reserve has now passed into the possession of France and Poland

China is our nearest rival in coal riches, having in addition to large areas of bituminous, the largest known anthracite reserve in the world.

Methods of mining coal. The methods of mining coal vary greatly. In western Pennsylvania and West Virginia the coal lies in a high plateau through which the streams have cut valleys so that the coal outcrops on the hillsides, making the entrance to the mines exceedingly easy (Fig 120, Coal Seam on Hillside). Pennsylvania anthracite lies in the folded and bent strata of mountains, the pressure of mountain-making having turned the coal to anthracite or hard coal It may outcrop in some places, as at Hazelton, so that it can be quarried from the surface. Nearby it is buried 3,000 ft. in the ground, requiring deep shafts which go below the level of the sea and involve much moving of rock, pumping of water and lifting of coal. Anthracite coal requires much sorting, cleaning, and preparing to get it clear of the shale (Fig 116)

The mines west of the Appalachians are mainly shaft mines of no great depth, those of Europe are almost universally deep, some of the shafts descending nearly a mile into the earth

Coal utilization. The ordinary methods of using coal as fuel in grates and furnaces are very wasteful, as much of the heat value of the coal goes off up the smokestack, unused, in the form of gas and smoke In gas making much waste often occurs in similar ways, and many valuable by-products are often allowed to run to waste for lack of suitable means for their recovery, but recent improvements in furnaces, smoke consumers, and espe-

cially in gas engines, the most economical form of power generation, and a new process of making the gas called producer gas, promise to be revolutionary in increasing the usefulness and life of our coal deposits The producer gas plant can get the combustible carbon in the form of gas from any of our coals, even from Texas lignite, or from peat itself, from wood, from tan bark refuse, and even from dried sewage, although these latter,

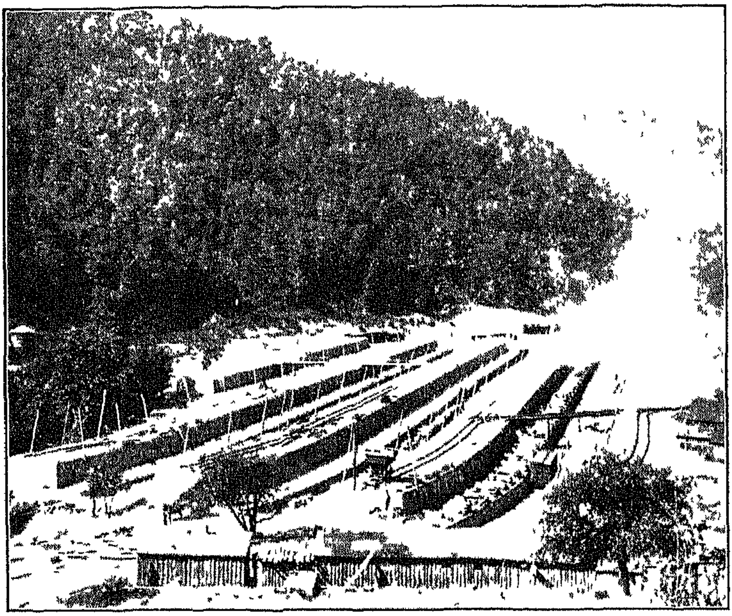


Fig 121 —The little mine car brings the coal to the wasteful beehive ovens and the box car carries away the coke Western Pennsylvania

have not yet been used on a commercial scale. This process of using low-grade fuel offers great power possibilities to many lands poor in coal but rich in peat, such as Ireland, where one-fifth of the surface is covered with peat bogs Peat also covers large areas in Scotland, Sweden, Denmark, Russia, Canada, and New England.

The recently perfected process of briquetting enables the use, as fuel, of coal dust and fine fragments which would otherwise

have to be discarded as mine refuse. Briquettes are compressed lumps of coal made by mixing small particles of coal with some adhesive material and pressing it in moulds so that it holds its shape until burned. In Germany 35 million tons of briquettes were made in 1922, while the industry is only getting started in the United States after many years of trial. It should enable

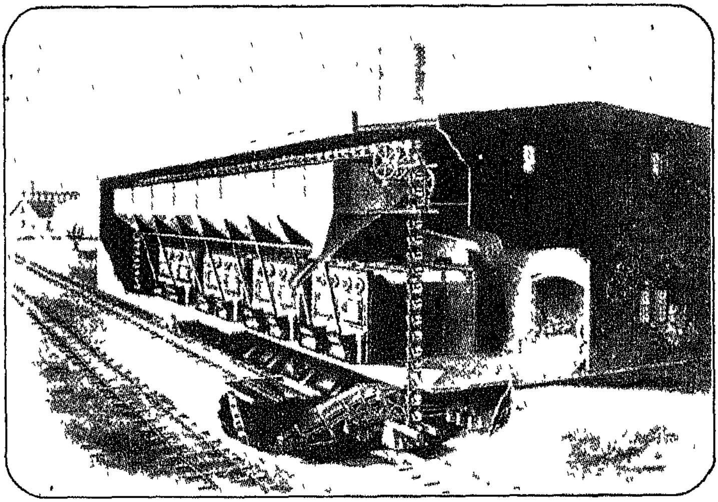


FIG 122 —Power plant where mechanical devices carry coal from car to furnace, feed the furnace, and load the ashes on the cars

us to save millions of tons of coal now wasted. Its greatest promise may be in connection with coke

Coke, gas, and gas by-products. Iron making requires the use of coke Coke is made by heating coal in closed retorts where the gas and liquid matter are driven off as vapor and the coke is left in big lumps that are harder than the coal itself and therefore hold up the burden of the ore so that the fire in the blast furnace does not smother. By the old coke methods, the coal was roasted in simple "beehives" or conical kilns of brick (Fig. 121), and the gas and liquids were usually allowed to escape as undesirable refuse The modern "by-product-plants" for distilling coal are elaborate and expensive but they quickly pay

for themselves by converting this refuse matter into a great variety of useful and valuable products. In coke making sometimes as much as 10,000 cubic feet of gas per ton of coal may be entirely wasted by the old-fashioned beehive oven, or saved by an improved by-product coke oven The purification of the gas from the by-product coke oven and also from the producer plant gives several pounds of crystallized ammonia and several gallons of tar per ton of coal. The ammonia is a valuable fertilizer, the tar is used for roofs and roads besides furnishing a host of chemicals and dyes If refined in elaborate works, we should be putting scores of millions of tons of soft coal through this process and getting dustless coke to burn instead of anthracite coal England is doing it Here again technique is ready, only conservatism blocks the way

The Germans, scientific, thrifty, and poor in coal, led the world before the World War in the manufacture of by-product coke, coal-tar by-products and gas engines. The by-product oven gained ground more slowly in America, and we are still wasting much fuel in the old-fashioned beehive coke plant, in wasteful steam engines and in wasteful mining. These facts in combination with the rapid increase of manufacture and commerce are causing some concern for fear of the exhaustion of our coal resources at a much earlier time than we previously thought possible. The price of coal is rising and must continue to rise This turns our attention again toward substitutes, of which the chief are water-power and petroleum, now both in active competition with coal. Of these, the oil may have an advantage of cheapness while it lasts, but all the minerals are at best an accumulation soon robbed and are but ephemeral in comparison to water-power which, depending upon the sun, the sea, and the highlands, remains an enduring source of power while climate and land endure.

An example of this competition between the coal mine and the waterfall comes from the Rocky Mountains

On the extension of the Chicago, Milwaukee, and St. Paul railroad to Puget Sound, the many waterfalls combined with the long and heavy haul necessary to provide coal for locomotives, led to the great undertaking of installing electric power on the entire system over the mountains. This work is successful and

may revolutionize railroad engineering wherever water-power is available and grades and traffic are heavy The initial cost of such equipment is enormous, but there can be no doubt of its final advantage over coal

2 Water-power

Water-power resources. The water-power resources of a country are chiefly its lakes and its streams These are affected by many circumstances For the best results in developing water-power a stream must have water enough and fall enough to turn the heavy waterwheels, and most important of all, the

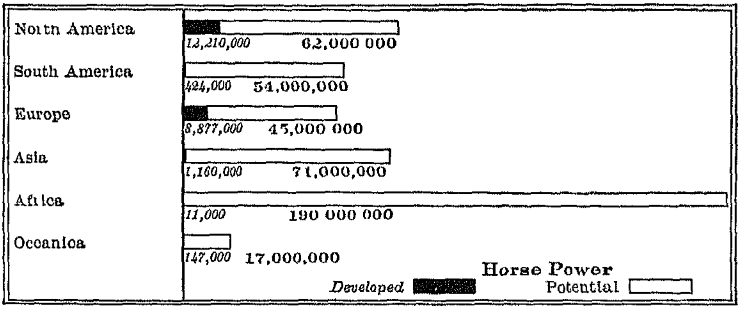


Fig 123 —The developed and the potential water power of the world, 1920 (From United States Geol Survey)

flow of water must be constant (Figs 125, 128, 129) The seasonal distribution of the rainfall may give 3 months' flood and 6 months' drought in which torrents become, at times, dry stream beds, a condition often found in monsoon countries and regions where the Mediterranean type of climate prevails Here water-power plants may be idle a large part of the year unless there is some kind of water storage to supply the necessary uniform flow

The water runs away more quickly from hilly than from level land. Even where the rainfall is well distributed throughout the year, there is, in small short streams, a great variation in volume because of the quick running off of the water after rain. A large river system tends to even up these inequalities

A most important factor affecting water power value of a given rainfall is some form of natural water storage. The spongy leaf mass of the forest floor holds water and makes more even stream flow and better water-power on the forest stream than is furnished by one draining tilled lands. Swamps and marshes are better yet, and lakes are the best of all for natural water storage. Man improved streams by building dams to hold the water, but

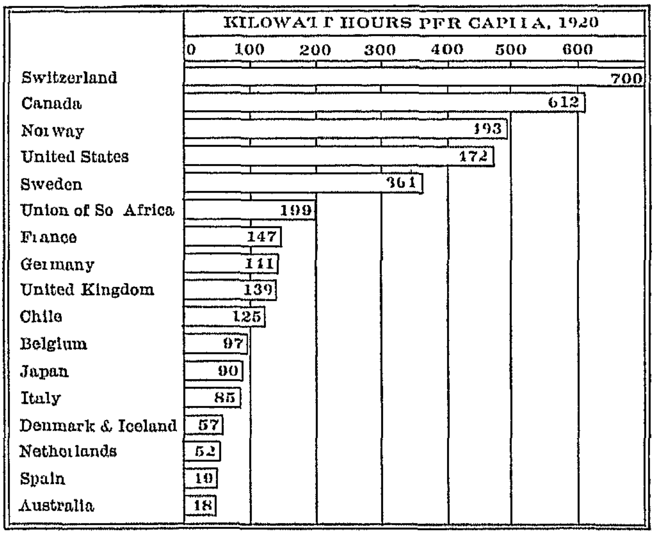


FIG 124 —Per capita consumption of electric current in the principal countries of the world (United States Dept. Com)

the natural reservoirs of lakes are many fold better, they hold waters that would otherwise be wasted in freshets, and let it out in time of drought. As most of the world's lakes are due to the work of glaciers, the fact that an elevated region has been glaciated is, granted rainfall, the most important thing in deciding the worth of its water-power resources (Figs. 128, 129). Thus the Niagara River with its wonderful natural reservoirs varies but 35 per cent in volume, while the lakeless Potomac varies according to the amount of rainfall from 1,000 to 250,000 cubic feet per second.

Snow fields and glaciers are second to lakes as natural reservoirs and they have the particular advantage of releasing the water in time of summer drought, and holding it tight in a period of excessive winter precipitation. These factors, combining with a heavy rainfall and the high Coast Range, Cascades, and Sierra Mountains, give the Pacific Coast states nearly half the water-power resources of the United States.

The use of water-power. The use of water-power has had its ups and downs, depending on industrial conditions and inven-

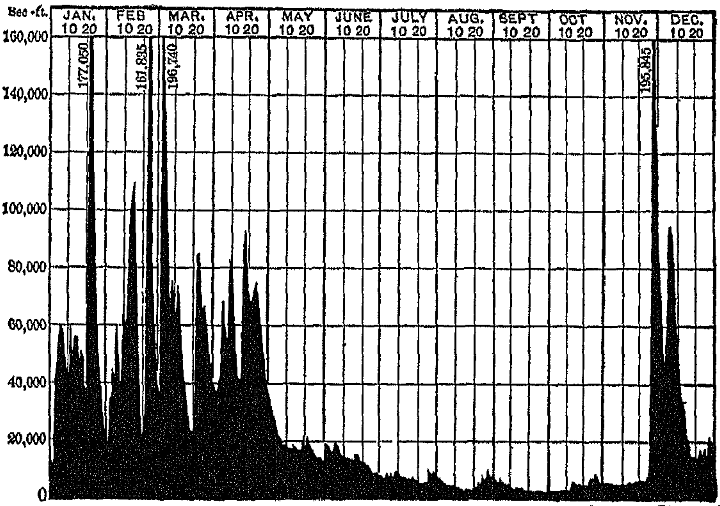


FIG 125 —Discharge of water in 1900 from the Susquehanna at Harrisburg, a river with a practically lakeless basin with much steep land (United States Geol Surv)

tions It was a factor of great importance in the American Colonies, furnishing as it did a means to grind flour and saw lumber The old-fashioned overshot waterwheels (Fig 126) so common in 1800 and in 1850 were largely displaced in the latter half of the nineteenth century by improved steam engines and cheap coal [1] But water-power is again coming into use since

[1] Small country mills were abandoned by the thousand as a result of this change.

the invention of the new turbine and Pelton waterwheels, and the ability to transmit power in form of electricity many miles to a convenient place of consumption The easy construction, effectiveness, and permanence of well-built cement dams (Figs 80, 127) are factors whose influence in water-power installation is now in full swing This influence alone is enough to give us a new epoch Since 1890 the use of water-power has increased

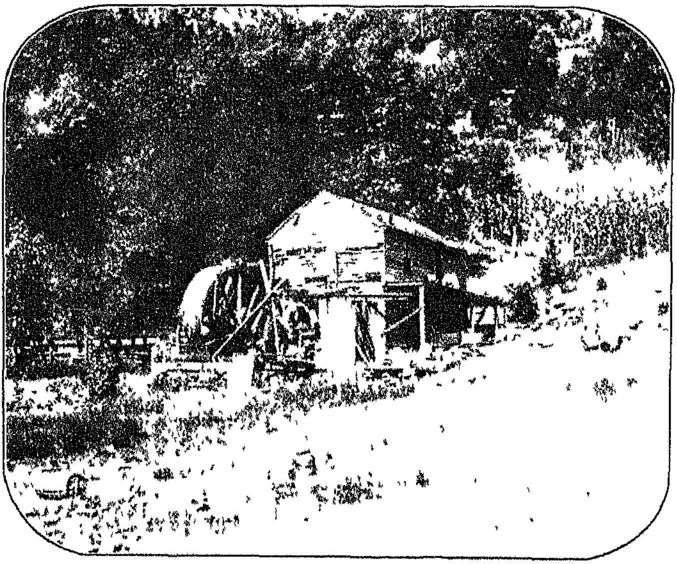


FIG 126 —Abandoned grist mill in Tennessee Old-fashioned overshot waterwheel, cornfield in background.

both in absolute amount and in proportion to coal-derived power An excellent example of this new competition of water-power with coal is to be found in Pennsylvania, the greatest coal-producing state in the world The Susquehanna River, whose tributaries drain two great and active coal fields, is harnessed by an enormous dam at McCall's Ferry, near the Maryland boundary (Fig 127). The power can easily be sold as far away as Philadelphia and Baltimore, in which latter city it runs the street cars This dam is merely one of many that might be built

on this river Plans for a second were under way in 1924 Even the navigable Mississippi has been dammed at Keokuk, Iowa, where 170,000 horse-power has been developed while boats pass through locks beside the dam

If we take a long point of view, the water-power of the glaciated region of northeastern United States (Fig 128) is likely to have a much greater value than all the coal of Pennsylvania Coal will go and the water-power will stay The best example of this is to be seen at Niagara Falls, where the glaciers diverted

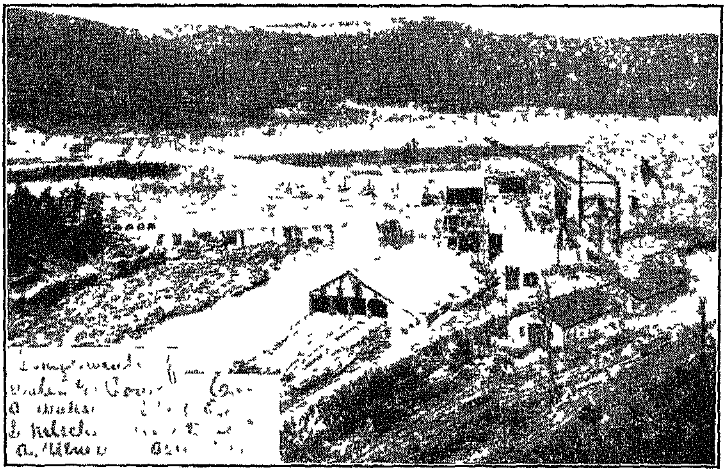


Fig 127 —Concrete dam built in sections across Susquehanna River, McCall's Ferry, Pa Power-house and forebay at the right. Tail race sheltered behind island to left, 200,000 horse-power within reach of Baltimore, Philadelphia and Washington (Penna Water & Power Co)

a single stream across a cliff of rock, forming the Falls which will develop about 6 million horse-power day and night if they are fully utilized Hundreds of smaller falls combined have a greater power than even Niagara and many of them are already in use, as in the wood pulp and paper industry which is scattered from Niagara Falls to eastern Maine It was this glacial water-power which started New England manufacturing The state of Maine itself has waterfalls that will yield a possible total of nearly 1 million horse-power In addition to this we are just

learning how to utilize the energy of tides from which it is estimated that a half million horse-power may be developed on the coast of Maine

New York state is about to begin making a series of state-owned reservoirs on the headwaters of some streams from which

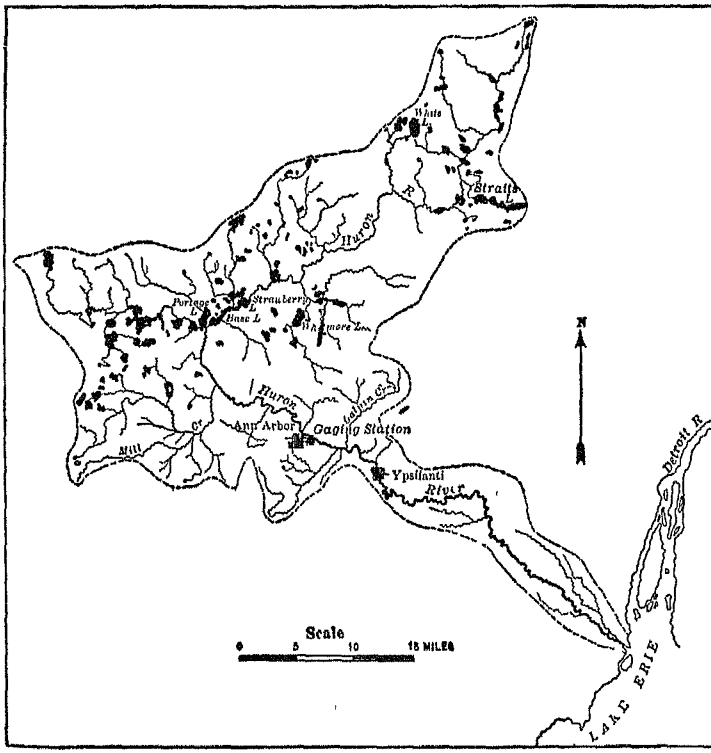


FIG 128—Basin of Huron River showing the natural reservoirs afforded by glacial lakes. (Newell.)

stored water will be released to be used many times as it passes through a succession of waterwheels on its way down to navigable water levels

Some of the waterfalls of the Sierra Nevada mountains in California are already harnessed, power being carried by one

company 241 miles to Los Angeles. The water that produces this power goes on down to raise crops by irrigation on the lowlands. Water-power is particularly valuable in the western states because of the absence of coal, and it is being utilized rapidly.

The competition of water-power with coal has in some places, such as California, been suddenly interrupted by the gushing wells of petroleum There has been a sudden and great increase in the production of this mineral fuel, along with increased knowl-

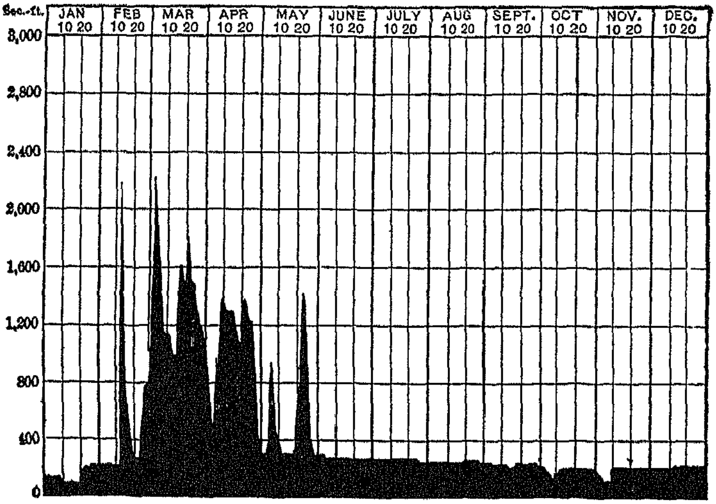


FIG 129 —Discharge of water in 1909 from the Cobosseecontee, a river draining many lakes in the Maine woods (United States Geol Surv) The attempt to make a river discharge a uniform stream is one of man's supreme combats with the uncertainty of deadly nature Compare the per cent of variation of this stream with that of the Susquehanna (Fig 125)

edge as to means of utilizing it efficiently. New engines of the Diesel type use crude oil in the same way that an automobile uses gasoline. Such an invention gives cheaper power to a generation or two of men, but it is likely to deprive future generations of the irreplaceable petroleum of which our supply is much more limited than that of coal. Since nothing now in sight can replace it in many of its uses, particularly for lubrication, this new means of using petroleum is of questionable benefit to the race.

The sudden new onslaught on petroleum as a source of power comes at the end of half a century during which this wonderful fluid has been of service in other capacities, chiefly as a source of

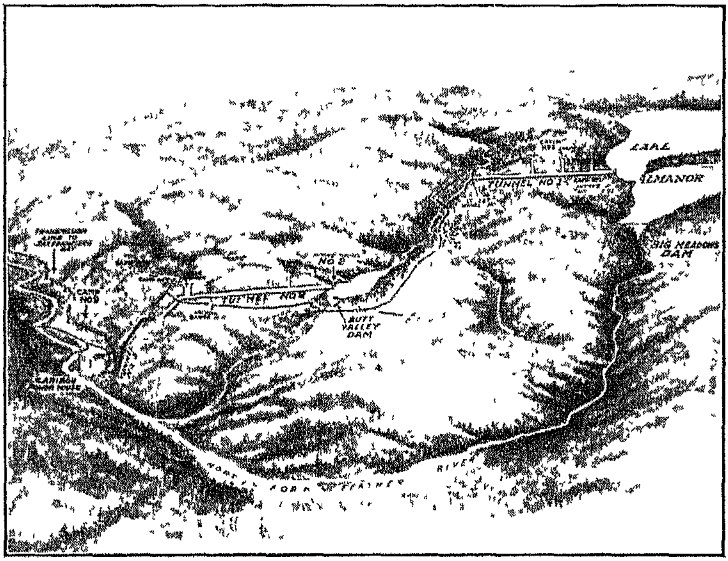


FIG 130—This picture of a part of the Sierra Nevada Mountains in California shows some of the ingenious things that have to be done to get power from water Capacity 44,000 kilowatts

light In 1923 we used nearly eight barrels per capita in the United States, an almost unbelievable figure.

3 PETROLEUM

The use of petroleum. Petroleum has helped greatly in spreading civilization over the world All the world loves light, which is so necessary for the reading habit and the spread of culture, and kerosene made from petroleum is, in every continent, the most common illuminant for the family lamp The lighter parts of the oil serve for illumination and as a fuel to generate power The heavier parts oil the wheels of the world's machinery, and the process of refining breaks it up into a surprising

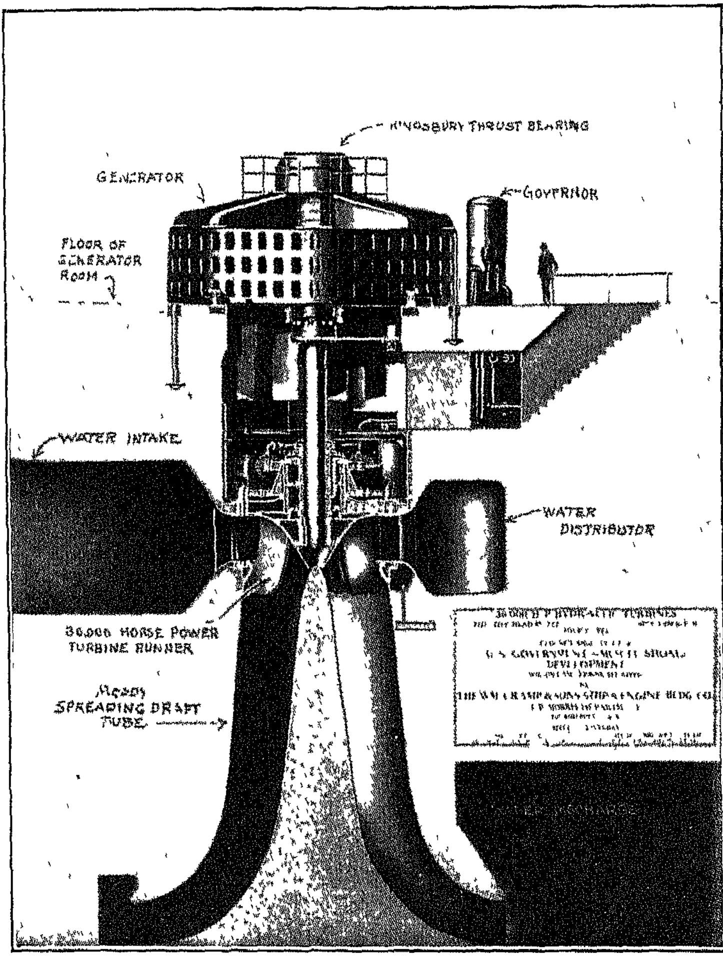


FIG 131 —Cross section of a power unit developing 30,000 horse-power The size of it is shown by the figure of a man on the platform

number of by-products, unless it happens to be burned in a furnace in cellar, factory, or ship

Petroleum collects deep down in the earth, especially in porous sandstones, with water and natural gas, the gas, being lightest, on the top, the oil next, and the water at the bottom. When the boring machine breaks the impervious cap that seals the oil sands, the oil gushes from the earth, due to the great pressure of the gas imprisoned with it. This sends the oil forth as soda water blows itself from a bottle.

The American oil fields. American prominence in oil production has been due in part to the fact that it was first discovered

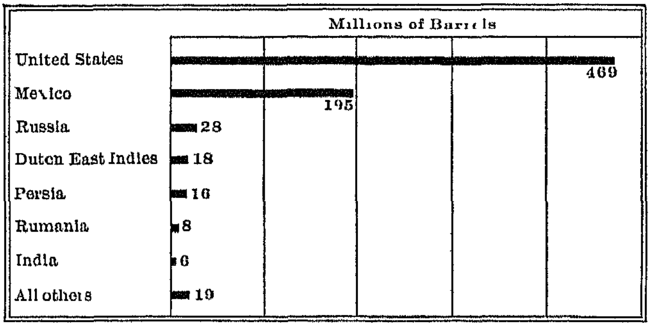


FIG 132.—World production of petroleum, 1921. Notice the present dominance of the United States and Mexico

and developed here, but more especially to the discovery of field after field, a process which has caused our annual output to increase nearly 500 per cent in the past decade and a half, so that America has two-thirds of the world's production. The oldest American oil field, known as the Appalachian, runs from southeastern New York, southwest through western Pennsylvania, southeastern Ohio, and the adjacent parts of West Virginia, an oil-producing region 160 miles long and from 25 to 40 miles in width. Within 40 years after the discovery of the first well, this field had 20,000 deep wells and 4,000 miles of pipe line to collect the oil in storage tanks and carry it to refineries. Large towns bearing such suggestive names as Oil City, Olean, Petrolia, from small beginnings grew large, rich, and prosperous.

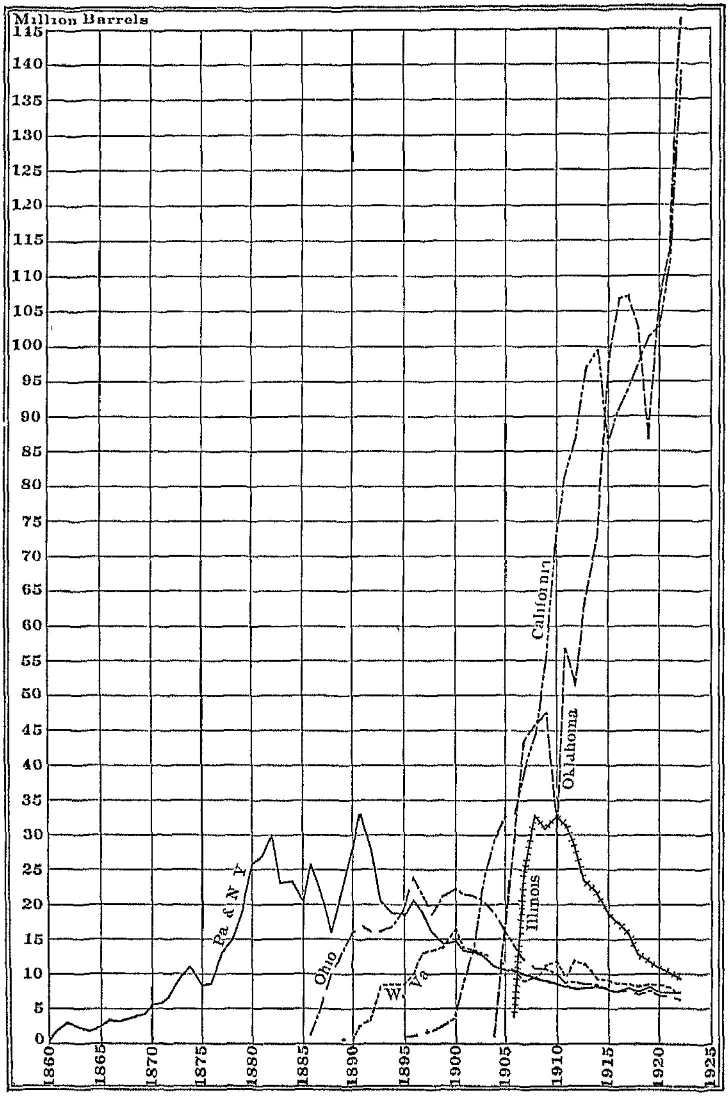


FIG 133.—Petroleum production in the United States (barrels of 42 gallons). (United States Geol Surv) Petroleum is a meteoric industry. Notice the changes in state leadership.

the western fields, as it has the eastern The demand for gasoline, fuel, and lubricating oils has fully kept pace with the tremendous expansion in petroleum. The United States is already importing petroleum from Mexico and the future user of oil products may be obliged to turn to other sources

Oil from shale. Two reserves, however, stand between the exhaustion of our present oil fields and the necessity of using alcohol. One is oil shale. It exists in great quantities in our Rocky Mountain region and oil from it can be obtained at somewhat greater cost than we now get it from wells Important shale areas in the western United States and Canada are duplicated in New Brunswick, Europe, and probably in many other parts of the world Distillation of the shale, however, is both difficult and expensive, as the crude oil is obtained by heating (distilling) the shale in great retorts, and the process has not been reduced to a basis where it can compete commercially with oil wells Scotland and some of the other European countries have been using shale oil for years The average grade of shale in this country will produce one barrel (42 gallons) of crude oil to the ton At our present rate of consumption the shale deposits of America have locked up in them sufficient oil to last us a century

Our other reserve is benzol, of which every ton of soft coal can be made to produce several gallons, along with ammonia and gas, by the previously mentioned process of heating it before it is finally burned as soft coke or coke briquettes.

Transportation of petroleum. The fact that petroleum products are used in almost all countries and exported from so few necessitates large transportation The problem of handling this inflammable fuel has been difficult At first, barrels were used, then came iron tank railway cars, and lastly pipe lines where the traffic is great Iron pipes 3 to 6 inches in diameter are laid over long distances to connect oil fields with great markets and ports of shipment Thus Oklahoma oil is now piped to the Gulf Coast or to St Louis, Chicago, Philadelphia, and New York The recent large production of the California fields has resulted in several pipe lines from the wells to the Pacific Coast The natural accompaniment of the pipe line is the tank steamer, holding hundreds of thousands of gallons and loaded by merely letting the liquid flow in from the pipes Such vessels connect with the

pipe line at the ports of Mexico and Texas, and carry crude petroleum to the refineries of Europe, as well as New York and Philadelphia.

ESTIMATED PETROLEUM RESERVES OF THE WORLD, 1921[1]

	Percentage	*Millions of Barrels*
United States	14 0	9,150
Southeastern Russia, Southwestern Siberia and the Caucasus	9 0	5,830
Persia & Mesopotamia	9 0	5,820
Northern South America, including Peru	8 8	5,730
Mexico	7 0	4,525
Southern South America, including Bolivia	5 4	3,550
East Indies	4 6	3,015
China	2 1	1,375
Japan & Formosa	1 9	1,235
Rumania, Galicia & West Europe	1 7	1,135
Canada.	1 5	995
India .	1 5	995
Algeria & Egypt	1 4	925
N Russia & Saghalien	1 4	925
Additional Deposits Probable	30 7	20,000
Total	100 0	65,205

[1] From "Some Great Commodities"

Petroleum as a source of power. The first great use of petroleum was for illuminating oil and then for lubrication, but with the opening of the twentieth century it has rapidly increased in use as a source of power. First came the engine run by gasoline, one of the petroleum products, now so important to the automobile. Then came the use of crude petroleum as ordinary boiler fuel. This has had its chief use in ships where oil tanks take up less space than coal bunkers and the crew can be reduced because the flowing of the liquid replaces the labor of coal passers.

Oil is also a good locomotive fuel, and as the great oil fields of Oklahoma and California are at the ends of a region where coal is scarce, the cheap oil of the new fields was quickly utilized by

the railroads It now drives the locomotives on 17,000 miles of railway between the Gulf of Mexico, Oklahoma, Utah, and California

The third and newest use of petroleum as a source of power is in the German invention of the Diesel engine, an internal combustion gas engine which has the great advantage (in cost) of being able to use the crude petroleum as it comes from the earth It is so efficient that a gallon of oil costing from 3 to 8 cents will develop 15 horse-power hours This invention promises to make oil a great power fuel while the present cheap oil lasts In Ger-

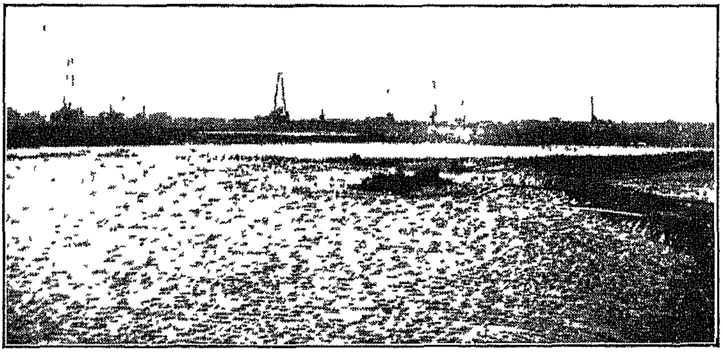


FIG 134 —Oil well, derricks and pipes discharging crude petroleum into a pool containing many thousand barrels, Muskogee, Okla (Standard Oil Co) This wasteful method is often necessary where every landowner works wildly to dig wells on his land, and the wells gush (20,000 to 60,000 barrels per day), so much that even pipes cannot carry it away.

many this engine is also being used to develop power from tar oil derived from the tar produced by the by-product coke ovens and the producer gas plants.

Natural gas. Natural gas, the most volatile of the petroleum products, is the best and most convenient of all fuels, the cheapest and most convenient of all sources of power. It separates itself from the oil as cream separates from milk, but it accompanies the oil in practically all fields The greater part of this gas, which is richer in heat than that manufactured from coal at so much expense in most cities, has been wasted, owing to the heedlessness of man in failing to provide proper means for

preventing its escape. The conservation of petroleum and natural gas has been a peculiarly difficult problem where every one owning as much as a backyard is free to dig a deep hole in the earth and let them run out. Thus the desire to get some oil causes every landowner to dig a well. Thus twenty wells (at $15,000 to $40,000 each) may be dug where one would get all the oil.[1] For many years the gas thus going to waste from oil wells in the United States was probably worth at city prices over a half a million dollars a day. In the American oil fields this gas has been of very great industrial importance in the iron and glass industries as boiler fuel and as city gas. It has been piped to many towns and cities outside the regions of its production. Most unfortunately the life of the gas well is short and the supply is exhausted in a few decades, but it furnishes an astonishingly cheap fuel while it lasts. In 1913 the average price per thousand cubic feet of gas was 5 cents; in 1921 this had risen to 26 cents—an indication that the era of cheap natural gas, like the era of free land and of abundant timber, is drawing to a close. With high prices the present gas supply is being more carefully conserved but that cannot bring back the amount wasted in the past or increase the future supply.

This resource has been the fourth element in making western Pennsylvania more liberally supplied with fuel than any other place in the world. In that region a thick forest covered the hills which were underlaid with the magnificent coal deposits of the Appalachian field, while further down was crude petroleum, and the natural gas that drove it spurting from the orifices in the rocks. The gas from this field is now about exhausted, the forest is practically gone, the oil output has greatly declined, the coal is being rapidly used up, and scenes of desolation face the traveler. No wonder the American people are beginning to consider the question of the conservation of natural resources—now that the richest of them are gone.

Refining of petroleum. Crude petroleum is very complex chemically and the process of refining consists of distillation.

[1] This waste of resource in getting oil is a strong argument for the idea that it should belong to the Government rather than to the persons who by chance own the land. Another argument may be seen in the effect of the oil riches on the owner.

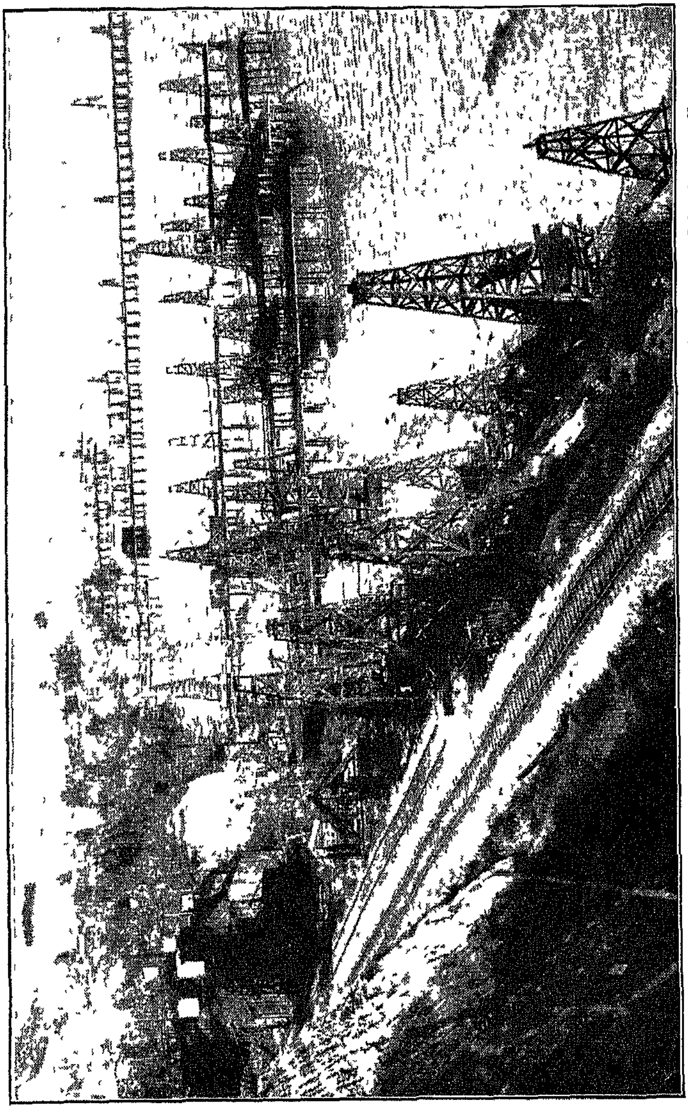


FIG 135 —A California oil field, Summerland, Calif (Southern Pacific Railway) This multitude of wells on town lots where a few wells would have secured all the oil is one of the reasons favoring the leasing of oil lands by the government in the interest of conservation

Every year many new commercial products are being separated from it. Among them are many kinds of oil from light naphtha to heavy paraffine oils, wax, paraffine, tar, and finally coke. Each product is capable of separation into others by redistillation, some of the products being vaseline and other ointments and drugs, so that altogether the modern petroleum refinery sells, in addition to kerosene, several hundred by-products, including tar which may be made into thousands of aniline dyes Thus we see why the refinery must be a large plant

Our foreign trade in petroleum. The American trade in petroleum products is as wide as the world Our oil makes better illuminating oil than that of Russia, and is sent, in the crude form, to some of the more important countries, while in the form of kerosene or refined petroleum for lamps it is distributed more universally than any other product of American export. It goes alike to Greenland and New Zealand, Norway and to the tribesmen in Italian East Africa. The ordinary 5-gallon cans of American refined oil are distributed throughout the interior of China in places where the face of the white man has never been seen And the empty oil can, what services does it not render, from house roof to city water supply (by way of vendors)! In 1923 the export of illuminating oil was 850 million gallons and that of gasoline and naphtha combined practically equaled it.

Considering the United States as a whole, it is a country with excellent equipment for manufacturing. Our resources of coal, iron, water-power, petroleum, food, and wood (see next chapter) are unexcelled. Yet the very abundance of our land and land resources serve as a drawback to the development of manufacture because of the opportunity they give for alternative employment.

Questions

1. How has the invention of producer gas been a relatively greater possible benefit to Dakota than to Pennsylvania?
2. Explain why an American coal miner gets out more coal per year than a miner in Europe?
3. How does it happen that water-power has varied so in importance in the United States?
4. Which is more valuable, the water-power of New England, the coal of Pennsylvania, or the petroleum of California? Give reasons.

5 Why is it more difficult with our present land laws to prevent waste in winning oil than coal?

6 Give some reasons why water-power is likely to increase as a source of power even where coal is available.

7 How is it possible to utilize water-power even at a considerable distance from its source?

8 Give some reasons why crude oil is shipped to European refineries rather than first refined and then shipped to Europe On the other hand, why is the refined product shipped to such countries as New Zealand, Greenland, East Africa?

9 What influence has the automobile business had on our petroleum supply?

CHAPTER X

THE FOREST INDUSTRIES AND PAPER

Civilization could scarcely exist without wood Wood has been useful in all stages of man's progress and the more civilization advances the greater becomes the service it renders. Each day

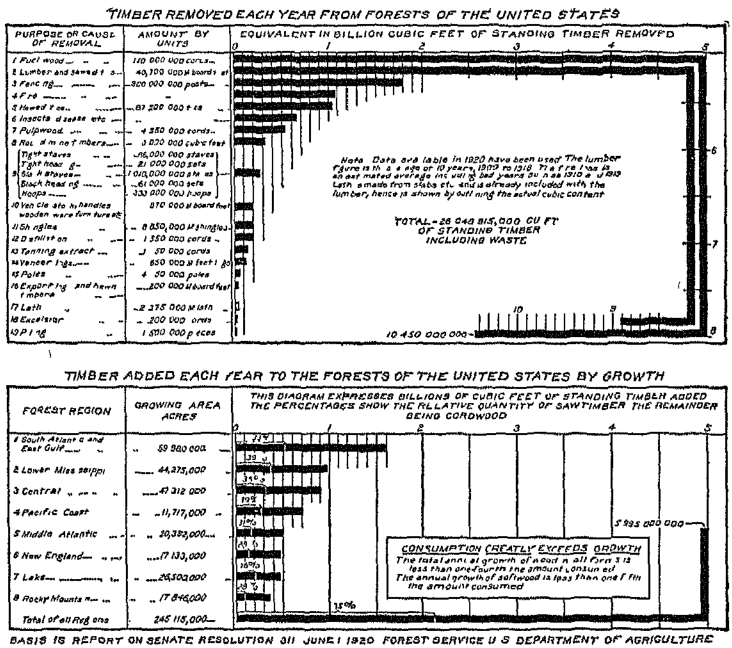


FIG 136—Each year we use four times as much timber as we grow What will be the end of this process of destruction?

some inventor finds a substitute for wood in one of its uses, but at the same time other inventors find corresponding new uses for wood, so that our dependence upon it is increasing day by day (Fig. 136). It has even become essential to the spread of knowl-

edge, for practically all our books and magazines are printed on paper made of wood pulp.

The American forests and their destruction. America is the richest of all continents in useful wood. Through much of our history our people have had to fight the forests. Against them the first effort of the new colonist was directed. He worked laboriously to clear away the trees before he could plant a crop (Fig. 137). He then had to struggle for years with the stumps

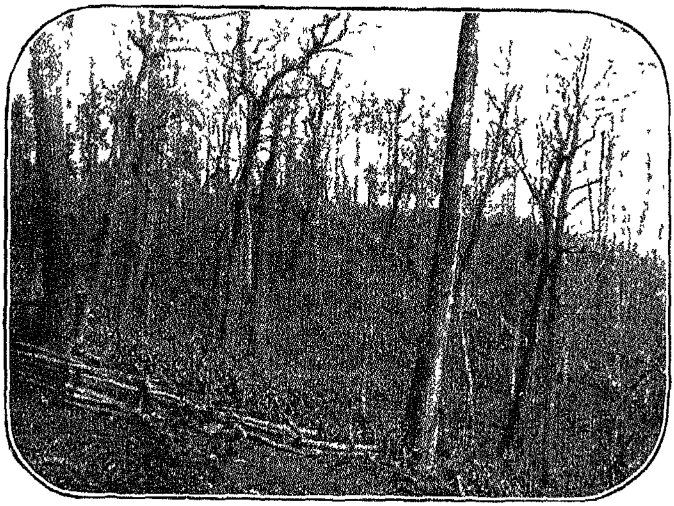


FIG. 137.—Cornfield made by the Indians' method of deadening the trees and letting them stand. Rail fence in foreground. Slopes of Blue Ridge, Mitchell Co., N. C. This process still goes on. (United States Forest Service.)

before he could have a smooth field in which to grow his food. Decade after decade, through the seventeenth and eighteenth centuries and the first half of the nineteenth, the settlement of the country east of the Mississippi went steadily forward, accompanied by the wholesale destruction of the forests by felling and firing to make room for the plow. Throughout this period of most active forest clearing the necessary lumber was usually made in little sawmills on local streams where the waterwheel drove a big upright saw up and down and ripped off the boards

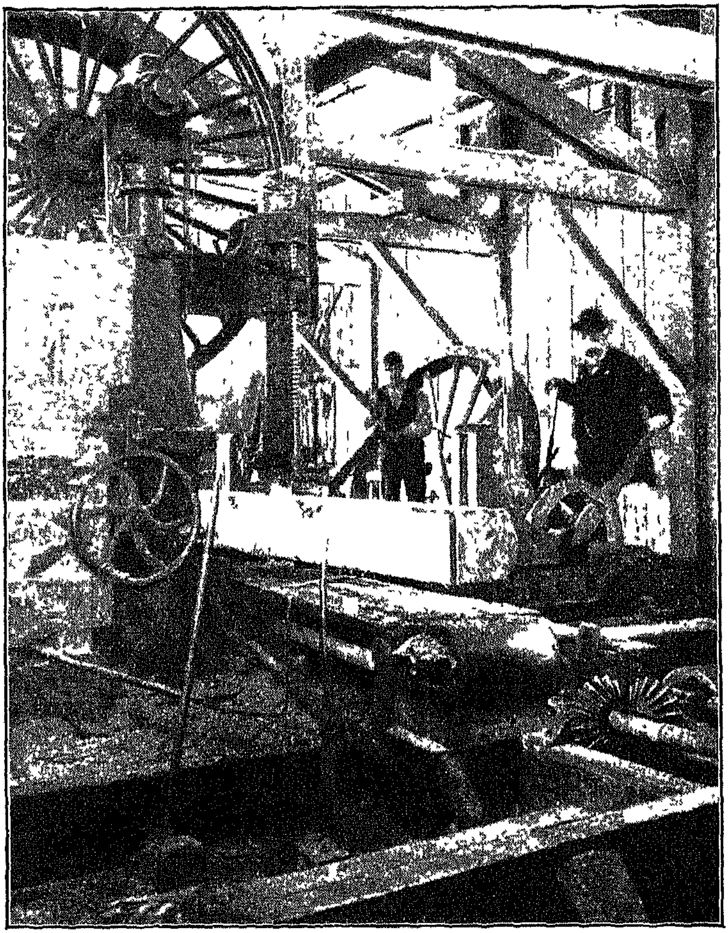


FIG. 138.—A modern sawmill The band saw runs over the large wheel at the top and rips off a board with great speed The squaring of the log wastes much wood (United States Forest Service)

one at a time for the man who brought his logs to the mill. Great improvements have since been made in the manufacture of lumber. The circular saw has replaced the upright saw, and in some cases the rapid double-cutting band saw has replaced the circular saw, especially for working up the large logs in the western mills (Fig 138).

The rise in the price of lumber. About the year 1900 America began to reach the end of an epoch in the lumber supply For 50 years the price of lumber had been steadily rising in Europe, while we in America had been cutting down the forests,

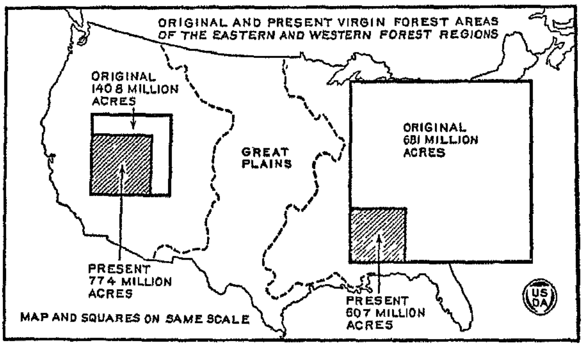


FIG 139—We have used all but a remnant of our original eastern timber and half of our western supply

burning up the timber to clear the land, using lumber prodigally and letting the forest fire run almost unheeded, to the destruction of the young trees that should have been making the lumber of the future The pine areas of the Great Lakes had long been supplying part of the lumber for the treeless northern Mississippi Valley with its thousands of towns and hundreds of thousands of farms. Suddenly there came an end to this lumber supply and the middle west began to import heavily from distant places. At the same time eastern lumber regions began to show signs of exhaustion, and lumber operators from New England, New York, Pennsylvania, and Wisconsin began to buy timber lands in the South and West, driving up the price by their competition for timber lands and driving up the price of lumber by the longer railway haul (Fig. 139).

Conditions for the lumber industry. In the past the price of lumber has usually been much less than a cent a pound, so that lumber making for the market has always been dependent upon very favorable conditions of transportation, being most profitable when it could depend, in part at least, upon water transportation The big log is more difficult to transport than the smaller boards, so the sawmills are situated as near as possible to the place where the trees grow The mill is often portable, moving about the woods sawing the logs of a few acres in each place, thus minimizing the log hauling A large sawmill is usually found only where the logs can be floated down a river or brought in by rail, so that it can draw its supply for many years from a large territory

Forests will grow in latitudes ranging from the heart of the tropics to the edge of the Arctic far beyond the grain line Granted moisture, evenly distributed throughout the year, no soil is too poor, too sandy, too rocky, or too steep, if the tree can once catch hold with its roots A tree will stand in the very face of a precipice if the feeding is good.

Within the forest the trees vary greatly in their suitability for lumber, most of which is made from a few species that are especially adapted by form and quality for such use. The shade trees commonly seen along the city streets of America and Europe are the broad-leaved deciduous trees They are usually poor timber trees because their trunks are apt to be crooked and a great proportion of their wood is in the branches The cone bearers are superior timber trees because they have tall, straight trunks with small branches, and because their woods are often softer and better adapted for easy use by man They can also thrive in lower temperatures and poorer soils As a result our familiar broad-leaved trees do not furnish over a quarter of the lumber used in the United States or in Europe.

The forest regions and lumber districts of the United States. The natural forest region of the United States comprises almost all the country between the Atlantic Coast and an irregular line extending from the mouth of the Rio Grande, to the Canadian border near the western boundary of Minnesota (Fig 141); a large area in the higher regions of the Rocky Mountains, and the Pacific forests on the Sierra Nevada and Coast ranges. It is too

dry for tree growth on the lower lands of California, of the Rocky Mountain region, the Great Basin, and also on the Great Plains. The prairie fires set by Indians to remove old grass from the pastures are supposed to have kept down the forest in large areas of the Mississippi Valley where trees now thrive, when man gives them a chance. There are seven important lumber districts in the United States, although the forestry map based on varieties of trees gives five forest regions

Northeastern district. The first of these seven districts is the northeastern, comprising the upper New England and Adirondack

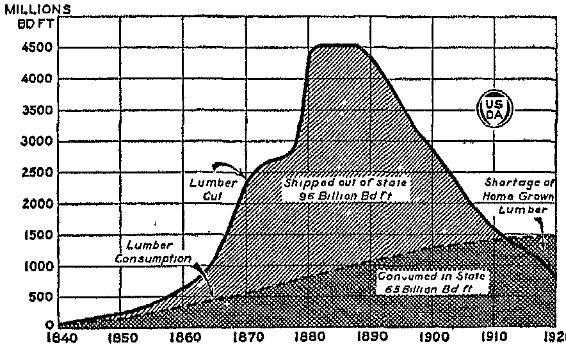


FIG 140—Michigan's alarming lumber record told most briefly It also tells much for every family within 1500 miles of Michigan

forests, occupying a highland with a climate rather too cold for satisfactory agriculture of nineteenth-century type Much of this cold country is impossible of tillage because of its steep and rocky surface. It was made rocky and also swampy and sandy by the work of the overriding ice in the glacial epoch But its rocky, swampy, and sandy soils can, if properly cared for, give us crops of wood indefinitely This lumber district, being easy of logging and near to cities, was the first in the United States to be largely developed The cold winter and heavy snow of this northeastern highland are essential factors in the lumber industry because the swamps and rocks, impassable by wagons in summer, are frozen firmly and covered by the deep snows of winter so that teams and tractors are able to sled the logs out to the stream bank where the melting of the snow in spring furnishes the

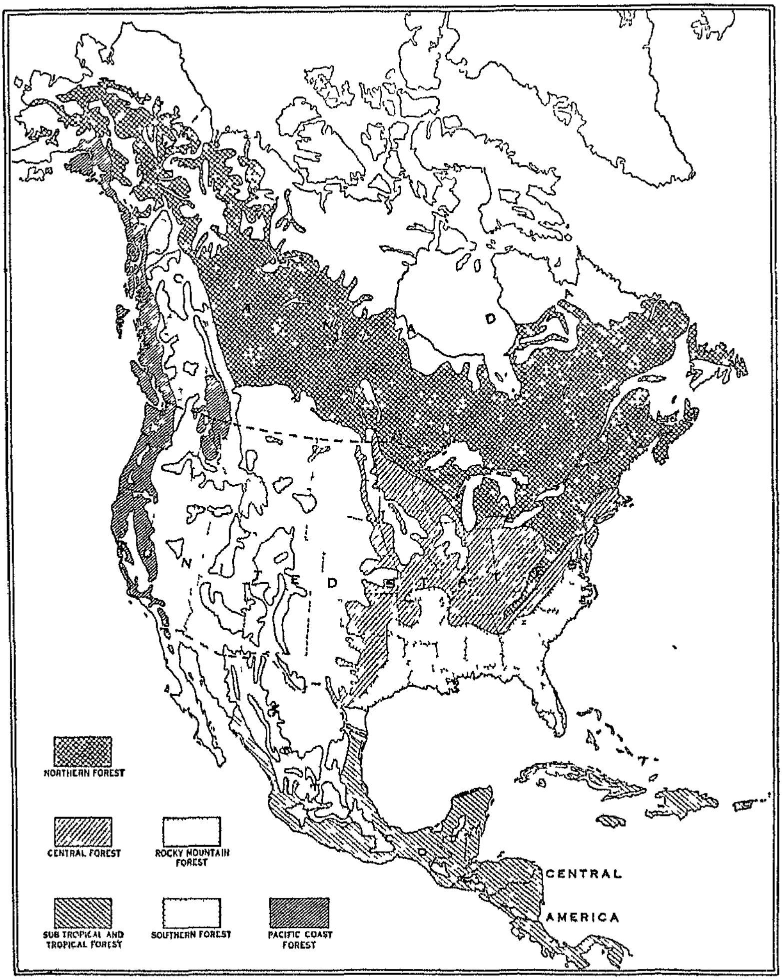


FIG. 141.—Natural forest regions of North America (United States Forest Service)

freshets which carry the logs downward to the mills (Fig 142). Thus Bangor, Maine, on the Penobscot, became a sawmill center.

The most important timber tree of this forest region was originally the white pine, a good timber tree yielding one of the very best of woods It is prized for its lightness, strength, durability, freedom from warping, cracking, or shrinking, and the ease with which it can be worked. The spruce is second, and the hemlock third in importance. The broad-leafed trees, includ-

FIG 142 —Snow is almost as good as railroads for the Northern Lumber Industry Thief River Falls, Minn (United States Forest Service.)

ing the maples, beeches, birches, and oak are often scattered through these forests, but they form a less important part of the forest growth in this and the next lumber district

The Great Lakes district. The second lumber district is that around the Great Lakes. Climatically, geologically, and industrially it is a westward but separated extension of the New York and New England field The lumber industry of this district shows the westward development that has accompanied the advance of the American people across the continent (Fig. 140). Lumbering in this district began in the lower peninsula of

Michigan, then went to the upper peninsula. Then Wisconsin succeeded Michigan as the leading state, but, as her forests diminished she was in turn succeeded by Minnesota Minnesota has now been surpassed by the rapidly rising lumber districts in the South and on the Pacific Coast The exhaustion of the white pine especially has been the impetus to make the lumbermen emigrate to new fields (Fig 144), and so thorough was the de-

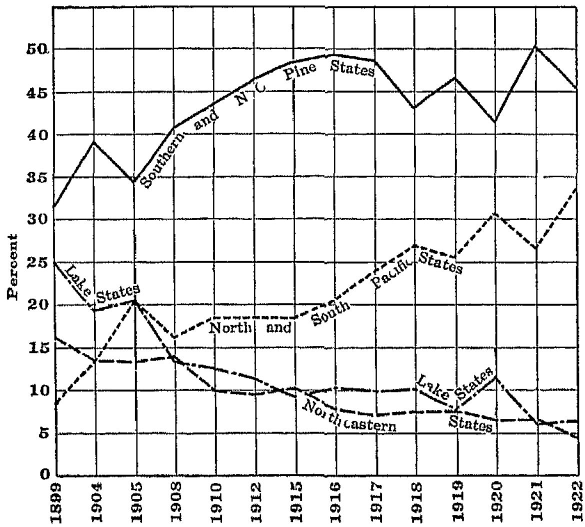


FIG. 143.—Percentage of total lumber production supplied by different sections of the United States

struction of the forests that all the Lake states had become lumber importers by 1920

The logging enterprises of the Upper Lakes have been a link in a peculiar industrial chain The one-crop farming that has characterized the grain-producing farms of the Mississippi Valley especially in the early decades of their use made a great demand for labor at harvest time, so that a farm having upon it one man in winter suddenly needed two or three more at harvest time. The total result was a demand for tens of thousands of men for a few weeks in a locality which needed them no more until the next season. For many years thousands of men passed the winter in

the logging camps in the Upper Lake forests, felling trees and hauling logs to the stream bank With the spring thaw, many of the choppers rode upon the log rafts down the Mississippi to sawmills upon its banks In late May they began the summer's work as harvest hands in wheat fields of Texas, and followed the advancing harvest season northward through Oklahoma and into the wheat belts of Kansas They also harvested hay and oats in that state and in Nebraska through July and early August, and

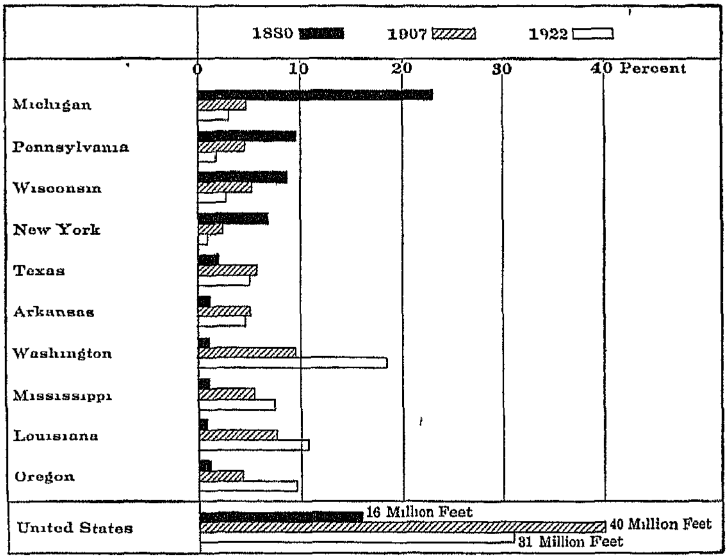


FIG 144—The shifting lumber supply as shown by percentage of output by states in 1880, 1907 and 1922 (United States Forest Service)

then took up the harvesting of spring wheat in South Dakota, southern Minnesota, the Red River Valley of the North, and Manitoba They followed the threshers through the frost of the autumn, and with the coming of winter rode eastward on the grain-carrying railroads to take up their axes once more in the lumber camps

Appalachian Highlands. The third lumber district is that of the Appalachian Highlands, reaching from southern New York to the northern parts of Georgia and Alabama. This region of

plateau and mountains, becoming higher as it goes south and reaching its maximum elevation in North Carolina, extends the temperature of New England far into the south, and with it the trees of New England In this Appalachian district the steepness of the mountains and the small amount of snow make impossible the extended use of sleds as in the New England, Adirondack, and Great Lake forests, and the logs are moved to the mills on wagons or, in some cases, on chutes of logs or steel down which the logs slide from the precipitous hills The timber has been almost entirely exhausted from the more accessible parts of this region By 1910 carloads of lumber were regularly shipped into Pennsylvania districts from which 25 years ago it was sent out by the trainload

Hardwood forests. The fourth lumber district is the middle region of hard woods extending from New York to Alabama, from Louisiana to the lower Great Lakes, and from Tennessee to the western edge of the Ozarks near the boundary of Kansas The evergreens, spruce, pines, and hemlocks hold the top of the Appalachians, and pine trees grow naturally upon the sandy Atlantic plain, but between these two on the lower slopes of the Appalachians and the hilly country leading up to them on both the eastern and western slopes is a large area where the forest is made up of the broad-leaved trees, oak, hickory, chestnut, tulip, black walnut, and to a lesser degree ash and basswood, classed as hard woods by the forest service [1] (see central forest in Fig. 141) This is the region from which the American supply of these hardwood timbers has chiefly come Chattanooga, and Evansville, Indiana, are great lumber markets, while Memphis is the greatest hardwood market in the world

[1] Commercial woods as classified by the forest service

Soft Woods	Hard Woods	
Pines	Oak	Cottonwood
Firs	Maple	Ash
Hemlock	Poplar	Hickory
Spruce	Gum	Walnut
Cypress	Chestnut	Sycamore
Redwood	Beech	Cherry
Cedar	Birch	
Larch	Basswood	
Tamarack	Elm	

Southern pine forests. The fifth lumber district is that of the southern pines, extending in an almost continuous forest along the Atlantic coast plain from Long Branch, New Jersey, to Austin, Texas (see Fig. 141). The most important tree in this district is the yellow or hard pine The strength and hardness of this pine make it much prized for flooring, interior woodwork, and many other uses In 1919 it furnished 37 per cent of all the lumber cut in the United States Various pines growing in this belt, particularly the short-leaf, loblolly, and slash pines

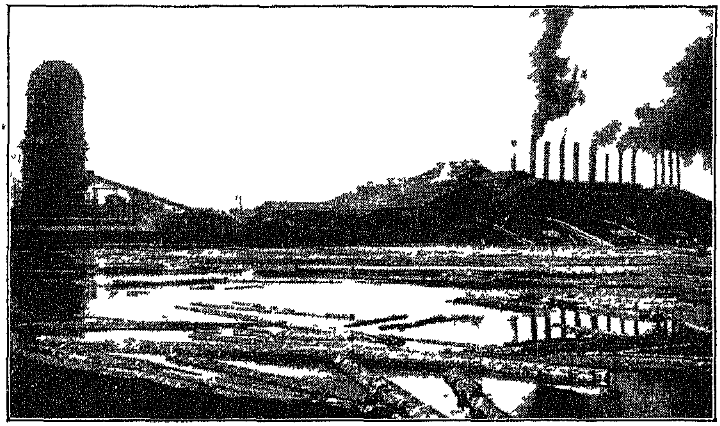


FIG 145 —A Louisiana lumber mill with a pond for log storage. (United States Forest Service)

grow very rapidly. Between 1860 and 1900 they covered many abandoned corn and tobacco fields in Maryland, eastern Virginia, and North Carolina with a growth large enough for the sawmill.

Much of this southern country is sandy and level, some of it gently rolling, but none of it is rugged. Lumbering is much easier than in New England or the Appalachian district. Much of it is done on temporary railroads which are put through the woods about 2,000 feet apart so that a donkey engine winding a cable 1,000 feet long can draw logs from any part of the woods to the side of the railroad track

The ease of lumbering has made for reckless cutting, so that the passing of the piney woods is imminent By 1920 four-fifths

of the original southern pine was gone. The cut-over pine lands of the South, estimated at nearly 80 million acres in 1924, are increasing at the rate of 2 million acres each year The warm moist climate makes this one of the best sections for the trees to replace themselves if properly cared for Under the practice of forestry the South can be one of the main sources of the nation's softwoods, but the South, like the rest of the country, is still backward in protecting its forests so as to insure regrowth.

The combined coastwise and export trade in this southern lumber makes large shipments from the ports of Mobile, Alabama, Pensacola, Florida, Brunswick and Savannah, Georgia, Charleston, S C., New Berne, N C , and Norfolk, Va , while the small town of Gulfport, Miss , is one of the greatest lumber-shipping points in the world Vast quantities of southern pine are also sent by rail into the Ohio and Mississippi Valleys

Another important timber tree in the southern field is the cypress, used for shingles and interior work It is one of the few trees that will grow in a swamp, where its roots must be under water The shifting source of cypress well illustrates the growing shortage of lumber, and the reasons for its rise in price. Norfolk used to be the great cypress market, but the comparative exhaustion of the Dismal Swamp supply caused Florida to succeed Norfolk, whereas scarcity in Florida has been followed by the rise of New Orleans as the chief market for the product of this swamp forest tree from the swamps of the Mississippi bottoms. Of increasing importance, too, are the gum trees, including tupelo, which, formerly considered worthless for lumber, were left standing while the cypress was being taken out

The Western Mississippi Valley and Rocky Mountain District. The central part of the Mississippi Valley north of the Ozark Mountains and west of Indiana was almost treeless save for the lower lands when occupied by the homesteaders in the second and third quarters of the nineteenth century Exception should be made of the moist lowlands along the streams where the growth of broad-leaf trees was of great value to the early settlers, furnishing them with wood for buildings and for fuel. At the North the humidity in the glacial swamps and the lakes had preserved forests west of the source of the Mississippi (see Great Lakes district above) and at the South, the Gulf rains had extended

the southern forests over east Texas and the hardwood forests over the Ozarks From the Missouri River to the Rocky Mountains, from Canada to the Rio Grande was a timberless area with one oasis of forest on the small highland, where the Black Hills of South Dakota and Wyoming, with a greater rainfall, supported a rather inferior tree growth (see Fig. 141)

Owing to the slight rainfall at low elevations, the Rocky Mountain forests grow only in high elevations (Fig 152), particularly in the South, but the lessened heat and evaporation make the area of the forest increase in Idaho and Montana. These Rocky Mountain forests, because of their dependence upon elevation,

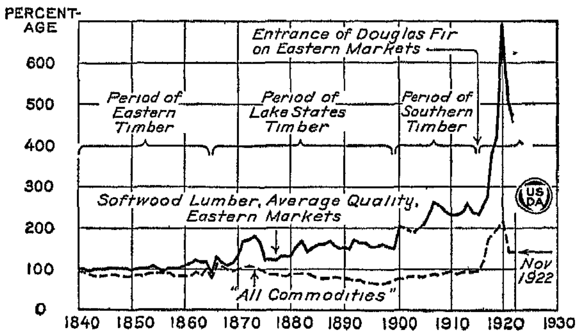


FIG 146 —The person who still feels that our resources are boundless should study this graph of the relative price of "all commodities" and soft wood lumber, average quality on eastern markets

occur in scattered patches (see Fig 141, Forest Map of United States) which increase in and toward the North The percentage of forest area is comparatively small in New Mexico, but it has many more square miles of forest than has New Hampshire There are even several thousand square miles of fine open forest upon the plateaus of northeastern and central Arizona, and there are large extensions of this same plateau forest in the mountains of northern Mexico to which no railroads have yet been built.

Owing to the prevailing coolness resulting from elevation, the Rocky Mountain forests are mainly coniferous; they include chiefly the western yellow and lodge-pole pine, spruce, Douglas

fir, and western red cedar Seventy-five per cent of this area remains uncut but it is often hard to get out and it has been sadly injured by fires

The Pacific Slope. The seventh forest district of the United States and the finest in the world is that near the Pacific Coast. This forest belt begins about latitude 35° in California, where it

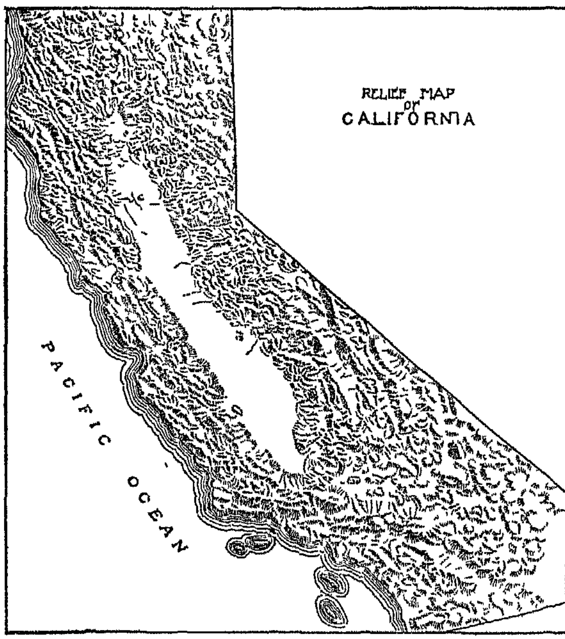


FIG 147 —Relief map of California. The treeless central plain is conspicuous in a state that is largely mountainous—an explanation of the importance of her timber resources (From Salisbury, Barrows, and Tower)

occupies the Sierra Nevada and Coast ranges, but low rainfall causes the great valley of that state lying between these mountains to be treeless, save along streams (Fig. 147), as are the lowlands farther south and east In northern California, parts of Oregon, and central Washington the forests cover not only both mountain ranges, but most of the valleys between. The second system of mountains, as we go inland (Sierras and Cas-

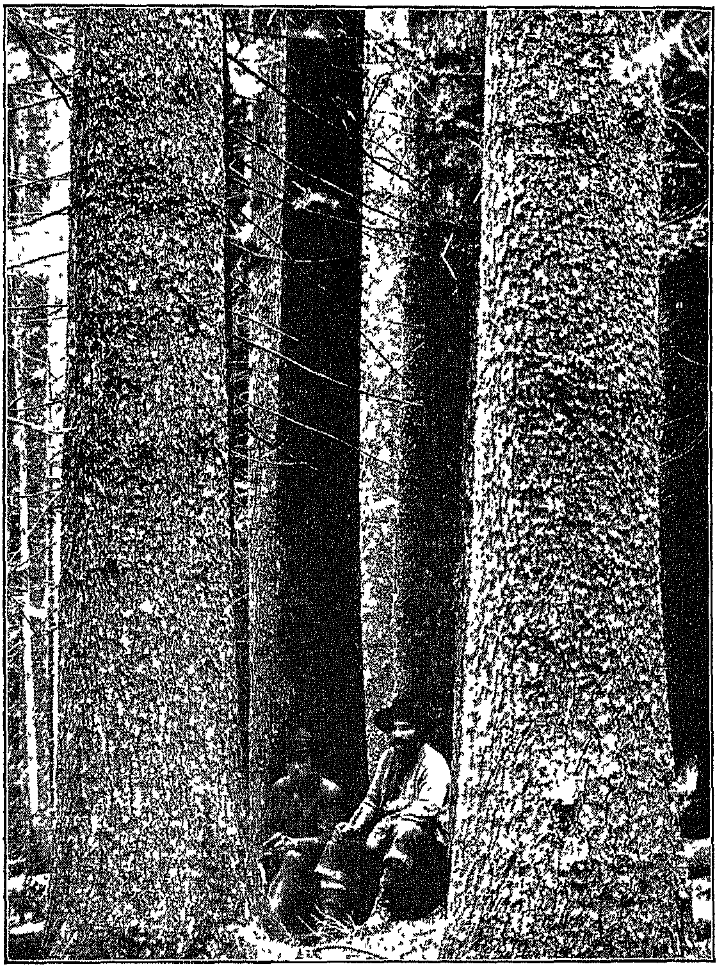


FIG 148 —Western white pine, the product of centuries The best stands will cut 30,000 to 60,000 feet to the acre (Blackwell Lumber Co , Coeur D'Alene, Idaho)

cades), sharply limits the rainfall so that, except upon the higher ranges, there is no forest in the Great Basin between the east front of the Sierras and the Wasatch Mountains of Utah, nor between the Cascade Mountains of west central Washington and Oregon and the mountains of Idaho, except where the Blue Mountains of northeastern Oregon lift their lands up into the altitudes of moisture and hence of trees

The even climate, a good rainfall, freedom from windstorms, and a dry summer, checking fungus action, permit the trees of

FIG 149 —Where fires have burned we have a triple ruin—loss of forest, erosion of mountain soil, and loss of water (Taken in the Rainier National Forest, Washington)

the Pacific forests to grow for ages and attain great size, as is shown by the well-known big trees of California [1] But commercially more important than these forest giants is the thick stand of California redwood, and the Douglas fir in all three of the Pacific states This tree grows from 4 to 8 or even 10 ft in diameter with straight trunks 100 ft. and even more in length It is difficult work to get these huge logs to the sawmill Because of this difficulty much fine timber is wasted As it is

[1] The wood of the big trees is almost unburnable and the thick bark holds water in a most unusual way—a great pair of fire protective qualities

utterly impossible to haul them on an ordinary wagon, they are sometimes dragged by donkey engines or long teams of oxen over a roadbed paved with small logs. Oftener they are taken on temporary railways, and sometimes they are allowed to slide by gravity down log chutes The largest must often be split by blasting before they can be moved at all. The lumber is manufactured in the largest and most perfect lumber mills in the United States, some of them using every particle of the log

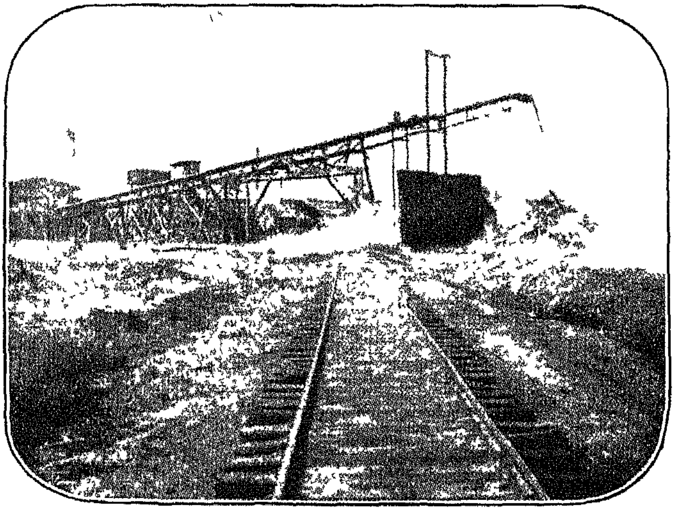


FIG 150 —One of our crimes against posterity is this Georgia sawmill slab fire that burned for 25 years without stopping (United States Forest Service)

that is brought to their wonderful machinery. A typical mill may produce shingles, lumber, and match-sticks from the finest portions of the logs, while the sawdust and bark feed the engine fires. Usually, however, there is an extra fire burning unused waste. Sailing vessels have for years loaded at Seattle and Tacoma, Wash , Vancouver, B C , Eureka and Humboldt, Cal , to carry this most excellent timber to markets of South America, Australia, Japan, South Africa, and even to England, France, and Germany, a voyage much longer than half the distance around the world.

The increased price of lumber in the United States permits the Pacific Coast lumber to be carried across the continent to Chicago and even to New York, and it has become an important article of freight eastward upon the transcontinental railways. The three Pacific Coast states now contain more than half of our remaining saw timber

Alaskan forests. The forests of Alaska are a continuation of those of British Columbia and those of British Columbia are a continuation of those of adjacent parts of the United States. In the southern part of Alaska, especially on the rather narrow

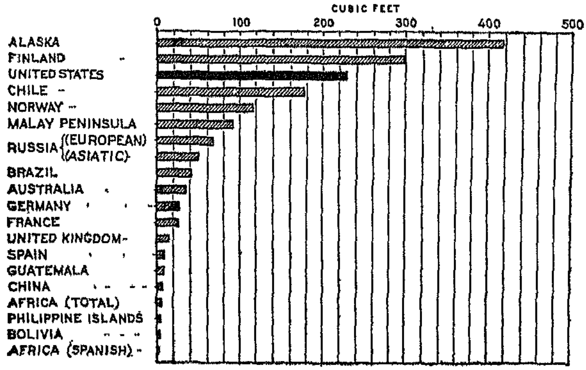


FIG 151 —Annual per capita consumption of wood, United States compared with various countries and regions The use of wood is closely related to the abundance or scarcity of it (United States Dept. Agr.)

Pacific Slope, there is a heavy rainfall and a considerable area of dense forests. In the interior of Alaska there is also forest growth along most of the streams, and the wood thus supplied has been of great aid in the operation of steamboats and for cabins and fuel for men hunting gold along those streams. But little of this timber of interior Alaska is large enough for the sawmill, its rate of growth is slow and it has had serious fire injury. However, it offers possibilities for paper making, for which purpose small trees are as suitable as large ones

The forest policy of the United States. The European experience of deforesting, timber scarcity and the resulting soil loss, tree planting, and forestry has at last been heeded to some

extent by the United States, especially since the rising price of lumber, beginning about 1900, has called the attention of all classes to the impending scarcity of timber Careful estimates by forestry experts indicate that at the present rate of use our timber supply will last possibly forty years, and that the rate of use is not likely to increase because of price limitations (see Fig 146) Therefore, our national government has set apart as national forests those parts of the government land which are unfit for agriculture but which have trees upon them. The map of national forests (see Fig 152) shows that they comprise large areas, mainly west of the Mississippi River, being nearly four times as large as New England, and comprising about one-fifth of the standing timber of the United States The national forests of California alone cover 29,000 square miles, an area one-half as great as New England Many of our states also own timber lands, but these are chiefly cut-over and burned-over tracts which have reverted to the state because no one will pay the taxes

The United States Forest Service, besides the all-important function of fire protection, manages the cutting and reforestation of the national forests in a scientific manner We may expect a steadily increasing output of lumber from this source, chiefly by the sale of full-grown trees to sawmill owners under conditions of cutting that will not destroy the growing trees The Forest Service recently opened up for sale and development a tract of 550,000 acres in eastern Oregon, estimated to contain 7 billion feet of mature saw timber The cutting of this timber is so hedged about by thrifty rules that instead of wholesale destruction of old and young trees alike, the timber trees will be removed carefully and the saplings safeguarded, so there will be a permanent yearly supply of 50 to 60 million board feet from that forest Our timber needs will compel us, as our population advances, to take better and better care of our forests, and to eliminate waste in lumbering The Forest Service estimates that careless cutting and milling loses 13 per cent of our lumber cut. We have thus far been chiefly in the hunter stage as regards lumber production. Just as the hunter goes out and shoots a wild rabbit, so the woodsman cuts a wild tree which nature similarly has provided. The systematic care of the forest increases

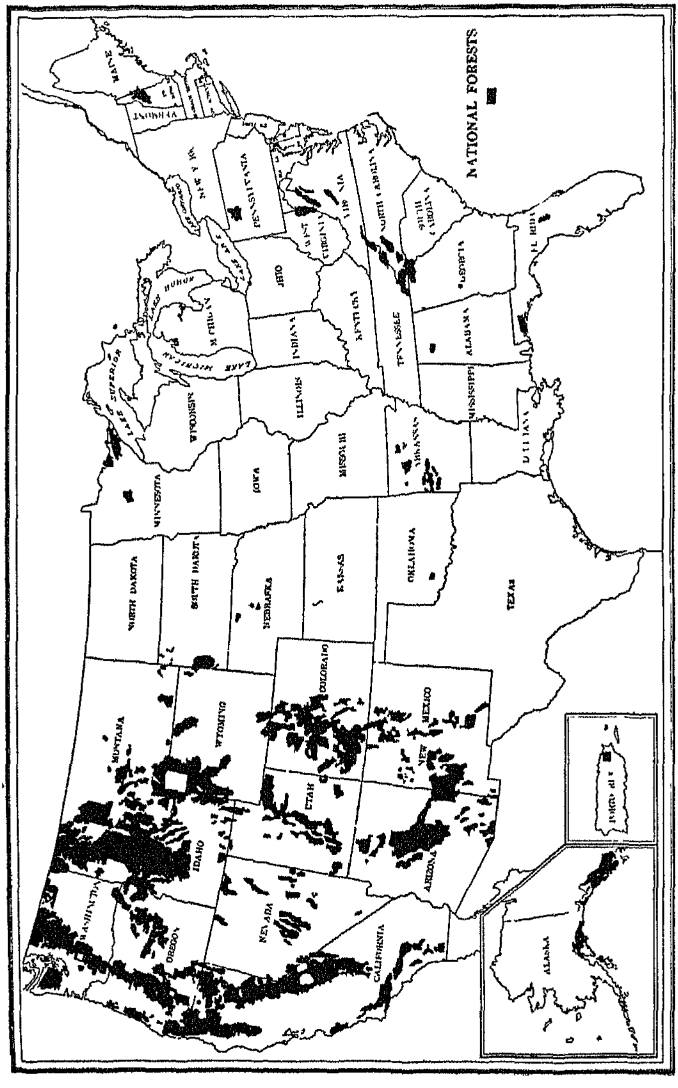


FIG 152.—Map showing distribution of the National Forests, 1924 Compare this with a physical map (showing mountains) and Fig. 67 showing unappropriated, unreserved government land (United States Forest Service)

its productivity several fold In 1923 we were cutting timber four times as fast as we were growing it

Great increase is also possible through the introduction of foreign trees. The bamboo, the great mainstay of the Japanese, thrives in parts of the Gulf region. The camphor tree grows well in Florida, and in California the eucalyptus, an Australian genus, has been found so profitable that good agricultural land has been planted with it This tree is phenomenal in that it grows to great size with great speed and at the same time makes a

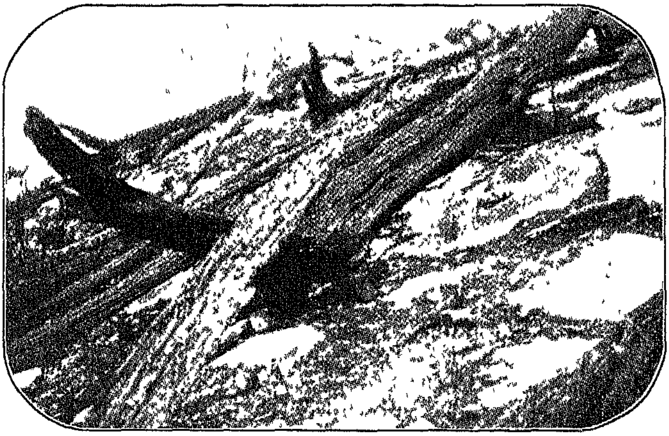


FIG 153.—"After man the desert" These rocks were covered with trees, roots and black soil before the forest fire Mt. Tabor, Rutland Co, Vt (United States Forest Service)

very durable wood Owing to its peculiar oil the wood is comparatively free from the ravages of boring insects and it is especially desirable for marine piling in docks and wharves, because the oil protects it from the effects of insects and water.

Naval stores and tanbark. Important among the many minor industries of the forest is the preparation of naval stores, the name applied to turpentine and resin, products of the sap of certain pine trees Resin is the product remaining after turpentine has been distilled from pine sap. The chief center of production is in the long-leaf pine forests of the southeastern United States, Charleston, Savannah, Jacksonville, Pensacola,

and Mobile, being important points of shipment The manufacture of naval stores, as carried on in the southern United States, is very injurious to the forests The sap gatherer makes great wounds in the base of the tree from which in a few years it bleeds to death During the process it is exposed to easy destruction by fire, and is easily overturned by wind storms. A newer way of turpentining, known as the cup and gutter method, does not gash the tree so deeply, and greatly prolongs its life and yield Inasmuch as the slabs which are burned or wasted around many southern sawmills (Fig 150) also contain large quantities of sap, as do the small branches and tops which are left in the woods, it is likely that the near future will see more economic methods of gathering naval stores Some processes already discovered take all this refuse wood, soak the sap from it for distillation and leave the pulp thus purified for making paper The French gather turpentine much more effectively than we do.

Another industry which has caused great destruction of American forests is the gathering of bark for tanning The chief bark trees are the hemlock and certain species of oak growing from Pennsylvania southward on both slopes of the Appalachians. Millions of good trees have been cut down for their tanbark alone, the trunks being allowed to rot. This shameful waste of logs goes on to some extent in the eastern country and also in California, where in the Coast Range there is considerable collection of tanbark from one of the western oaks that grows among the redwoods. The tanbark district of Wisconsin and Michigan (chiefly hemlock) is second to the Appalachian in output. More detailed information about this industry will be found in the chapter on Leather

Wood manufactures. The manufacture of the heavy log into rough lumber naturally clings to the forest, although special conditions cause some export of logs, especially of such high quality woods as mahogany and walnut The further manufacture of lumber, usually carried on in planing mills where the rough boards are finished, tends to concentrate near the market in or near centers where building operations are largely carried on, since the rough lumber is more easily moved and stored than the easily injured dressed plank or the sash, doors, blinds,

and special shapes that the planing mill turns out for the builder. There is a growing tendency, however, to attach the planing mill to the sawmill.

The same factors tend to locate furniture manufacture in great centers of consumption, especially in timber-importing countries. Thus London is both market for product and center for raw material because the imported wood is unloaded there from the ships. Owing to an early start when near-by timber supplies were abundant, and to very low freight rates since, we have had a great furniture industry developed near the former area of wood supply in Grand Rapids and other towns of the Lower Peninsula of Michigan, in Evansville, Indiana, and more recently the same industry is rapidly increasing in North Carolina. The recently perfected "knock-down" system of furniture making, which has been extended to boats and even houses, has helped many such cities to maintain their wood-working industry even after the near-by timber supply has been exhausted. The expense of importing the raw lumber is balanced by the saving in freight made by the "knock-down" system. Furniture is expensive to ship, not so much because of its weight, but because of its bulk. "Knock-down" furniture can be taken to pieces, permitting economy of space in shipping. In this way the parts of boxes and barrels (called shooks) are shipped ready to put up.

The sudden increase in the manufacture of veneer and its use for cheap industrial purposes is suggestive of the advancing economy of wood that scarcity and high prices are forcing upon us. Veneer is wood sliced into thin sheets like pasteboard or even like paper.

"Formerly veneer making was confined to a few hardwoods selected for beauty of grain and used as an exterior finish for high-grade furniture and cabinet work. With the improvement of veneer machinery and methods of drying there has developed a large demand for veneers cut from cheap woods and used for packing boxes, berry cups, fruit baskets, veneer barrels, drawer bottoms, filling in three-ply lumber, glass backing, and novelties, such as butter dishes, wooden plates, and fancy confectionery packages.

"On account of the constantly increasing price of hardwood lumber used for making furniture, fixtures, and cabinets, built-up

lumber, which is usually made of three-ply veneer, is being extensively substituted In manufacturing this built-up material, it is possible to use woods which heretofore have been but rarely used, owing to their tendency to twist and warp when sawed into lumber" (*Bureau of Forestry Report*) For many purposes this built-up lumber is better than the "natural" lumber

Paper. In 1870 when cotton, linen, and woolen rags were the chief dependence of the paper manufacturers, it would have seemed preposterous to place a discussion of the paper industry in a chapter dealing with forests and forest industries, but this is an industry which has been completely transformed by changes in raw material since that time

Paper is made of matted fibers Nearly all plants have cellulose fibers in them and as indefinite numbers of vegetable materials will make paper, the actual choice of materials is decided by the relative quality and the cost For two or three centuries cotton, linen, and woolen rags were the chief dependence for paper making. In 1857 an Englishman invented a process of making paper from a tough grass called esparto, which grows well on arid, sandy, and rocky land and is found wild over large areas in the Barbary States of north Africa and in Spain. In less than 30 years after its introduction it assumed an importance in English paper making greater than that of rags. By 1901 esparto was far outranked by the predominating wood pulp, which opened up to the paper industry a vast supply of materials at a relatively low cost.

Wood is pulped by mechanical processes of which the chief are simply grinding or cooking in chemical solutions, which eliminate all woody substances but the cellulose fibers, the chief basis for paper manufacture. The fibers float in water which is kept at a uniform soupy thickness by stirring. For centuries paper making was a handicraft carried on by the paper maker and his family, who dipped sieves into vats of floating fiber and carefully lifted out upon the wire gauze enough fiber to produce a sheet of paper when properly dried. Now machines turn out more than 500 feet per minute and send it away from the factory in sheets often miles in length wound upon spools into rolls 3 or 4 feet in diameter. If the paper is to be used for writing purposes, the spaces between the fibers are closed by a process

called sizing, which fills up the pores with material chiefly composed of china-clay, resin, alum, and talc, a process that greatly adds to the weight of the paper While the expensive hand method of paper making prevailed, its price was high, and demand for it small The discovery of wood pulp and the invention of machines to turn out paper in quantity has made it cheap enough for a wide variety of uses.

Paper from wood. The manufacture of paper from wood pulp was begun in the United States in 1866, and tree trunks [1] now make the greater part of the world's paper.

Before the pulp era, our paper mills, like our woolen mills, had been clustered along small streams in the vicinity of centers of population The great increase in the use of wood pulp for paper in the United States since 1890 has caused the transfer of the center of the paper industry away from the market to the forest districts of the New England and Lake states. Spruce, originally so common in this region, furnishes nearly three-fifths of the pulp wood consumed in this country, and two-thirds of the pulp mills of the country use water-power because, when available, it is the cheapest source for the great amount of energy required to grind the wood into pulp So important is this relationship of water-power to paper making that two-thirds of the water-power utilization in the United States is in the paper mills The combination of water-power and spruce logs makes the states of northern New England and the Lake district the greatest paper-manufacturing district in the United States. Relatively pure water is very important in paper making. Massachusetts leads in the making of rag and fine writing papers, for the manufacture of which Holyoke, on one of the falls of the Connecticut, with twenty paper mills, is the most specialized center in the United States. Pennsylvania, Ohio, and Michigan also rank high in the manufacture of this type of fine paper

The cheapest wood pulp paper is simply ground wood which

[1] The cheapness of this material greatly depressed the trade in, and reduced the price of esparto grass, which had been a staple export of many of the Arab tribes of north Africa The resultant hard times produced discontent, which, as is commonly the case, was blamed upon the Government, and the French rulers of Algiers had serious trouble with the tribesmen who found themselves poverty stricken through the loss that followed the decline in the esparto trade

makes the flimsy and perishable newspaper The better and more expensive kinds are made of chemical wood pulp to which rag pulp is added to give a superior surface. High-grade writing and book papers are largely made of spruce and poplar (aspen) wood and rags, the woods for these papers being pulped by a chemical process to give it longer and stronger fiber. Two-thirds of the news print paper, practically all made of spruce, comes from the Adirondack and New England highlands, while three-fourths of the remainder is made on the southern edge of the upper lake forests in Wisconsin.

Paper industry leads to forestry. A paper mill with its water-wheels and heavy machines is expensive, and the impossibility of moving it makes it necessary that a paper company shall be sure of its wood supply To do this they must often own the land, and, since they cannot flit from tract to tract after the manner of lumber manufacturers, some of the paper companies owning large areas of spruce land became the earliest large timber owners in the United States to protect their forests and cut them rationally—forestry. As their enterprises are often located in the deep forest, the companies must sometimes even build and own the towns in which the people live who make their paper. A good example of this is afforded by the town of Millinocket, Maine, where a huge paper mill turning out 250 tons of paper per day, was located far in the forest beside a great waterfall A special railroad was extended to it, and the town built around the mill The plant cost $25,000,000—an excellent evidence of the impossibility of moving and of the consequent necessity for conservation of wood supply, both by avoiding wasteful cutting and by replanting the burnt-over lands, but above all by the stopping of fires This same company owns over a million acres of forest land from which to draw its pulp-wood.

The paper industry is undergoing a change in the source of its raw material, since it has been demonstrated that a large number of native woods can be used. Already twenty species, including southern pine, hemlock and miscellaneous hardwoods are in use

Paper from straw. In the eastern part of the wheat belt in Ohio, Indiana, and Illinois, there is a considerable paper industry using straw, which makes cheap wrapping paper and strawboard, the so-called pasteboard of common use. Wheat, oats, and rye

straw is used, rye being considered best This is an industry which might easily move west and northwest with the moving wheat fields. Straw is used for making specialized paper products and is not competing with the use of wood

Our commerce in paper. No other people in the world use so much paper as do the people of the United States with their large consumption of newspapers, magazines, books, wrapping paper, and advertising. We import rags from Europe by the hundreds of millions of pounds. From Canada we are getting over a million tons of pulp wood, half a million tons of pulp, and nearly a million tons of manufactured newsprint paper annually. One of the surprises of commerce is the import from Europe of nearly half a million tons of pulp wood, chiefly from Norway, Sweden, and Finland American forests furnish less than half of our huge paper consumption Exports of paper from the United States are only 2 per cent as large as the amount we use

Questions

1 Are planing mills and sawmills commonly found in the same localities? Why?

2 Would the Upper New England forests be more valuable or less, if they had the winter of Tennessee or Maryland?

3 Explain from the map why Chattanooga, Evansville, and Memphis each ranks high as a lumber market

4 Explain how environment makes different methods of logging

5 The big tree (species sequoia) grows well in some eastern locations May we expect it to get as large as in California?

6 What is the effect of the discovery of chemical tanning materials on the future price of lumber?

7 Why do different manufacturers using wood regard forestry differently?

8 Should a factory for the manufacture of fine furniture be in a big city or a big forest?

9 How did an invention in paper-making cause rebellion in distant lands?

10 Explain how "built up lumber" is made of three-ply veneer Can you find out how the three layers of veneer are arranged so as to avoid warping that would occur if the same wood were used in the ordinary way? Mention several articles of furniture in which you have seen "built up" lumber.

11 How has chemistry made a contribution to industry?

CHAPTER XI

FIBERS, TEXTILES, AND CLOTHING

The United States, with its great lead in cotton growing, is the greatest factor in the production of raw material for the world's clothing The United Kingdom has a similar leadership in the textile manufactures, one-seventh of her workers being employed with textiles and clothing, while in the United States but one-sixteenth are so employed The clothing of mankind is the product of wide-reaching world industries, which, with the production of the raw materials, touch in varying degrees all countries. A multitude of fibers contribute, but cotton is much the most important In an average year we use five or six times as much raw cotton as scoured wool, its closest rival.

1 The Supply of Raw Cotton

The universal use of cotton. It is probable that few readers of this book ever saw a person into whose clothing cotton did not enter in some part, for it is alike the raiment of princes and of primitive peoples.

Cotton was in extensive and general use in India as much as twenty-seven centuries ago. Unlike most other important plants, its distribution throughout parts of the world suited to it took place at a very early time, probably by natural means, for Columbus and other discoverers found it in general use in the West Indies, Brazil, Mexico, and the Pacific Islands

Until the end of the eighteenth century it was one of the most expensive of fibers, because hand labor was the only method of separating the fiber from the seed The difficulty and slowness of this work made cotton more expensive than wool and linen, and caused it to be relatively more expensive than silk now is. The poor of 1790 had to choose between wool, linen, and leather, and this last material, in the form of workmen's clothing, played a much more important part than now in man's raiment.

During the century following the invention of the gin, cotton became the well-nigh universal clothing It has almost entirely replaced linen, is with increasing success competing with wool in the soft and warm flannelettes and canton flannel, and it is also very generally mixed with wool in the production of cloth, to which it adds cheapness and in some cases durability. Other

FIG 155—The branching habit of the cotton plant and its uneven ripening has long baffled the inventors of picking machines (United States Dept Agr)

cotton fabrics, such as sateen, greatly resemble silk, while mercerized cotton is often sold as silk, so that cotton is being used as a substitute for this more expensive fiber also

Natural cotton regions. Cotton is a woolly fiber attached to the seeds of a shrubby plant and contained in a pod or boll, which at ripening time opens so that the white fiber protrudes in a mass about the size of a small apple (Fig. 155) Naturally tropical and sub-tropical, the plant will grow almost everywhere throughout the world between 40° north and 30° south The

northward growth of cotton is limited by the requirement of about seven months of frost-free weather (see Fig 75 of frost-free periods). It also needs a good summer rainfall without too great an excess of rain, a uniformly warm summer without too excessive heat, and bright sunshine A frost-free season from April 1 to Nov 1 is thus a necessity unless the plants are started under glass. Owing to combinations of geographical and in-

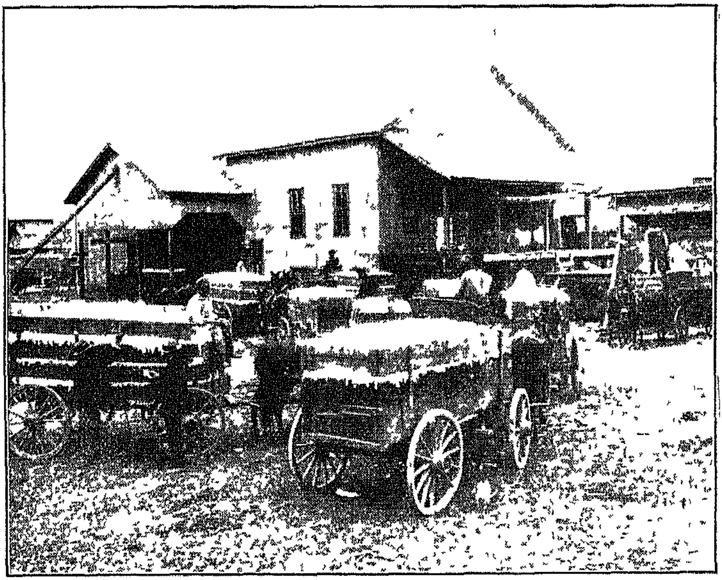


FIG 155 A —Community cotton gin owned and operated by negroes in Alabama The wagons are loaded with seed cotton as it comes from the field.

dustrial conditions, it is exported as yet from few and comparatively small areas and thus in its distribution throughout the entire world, it gives rise to a great commerce

The possible cotton area in the United States. It is estimated that 700,000 square miles of the southern part of the United States have a climate suitable for cotton Owing to the ease of injury by too much rain and cloudy weather the coast districts of South Atlantic states are not so well fitted as the districts

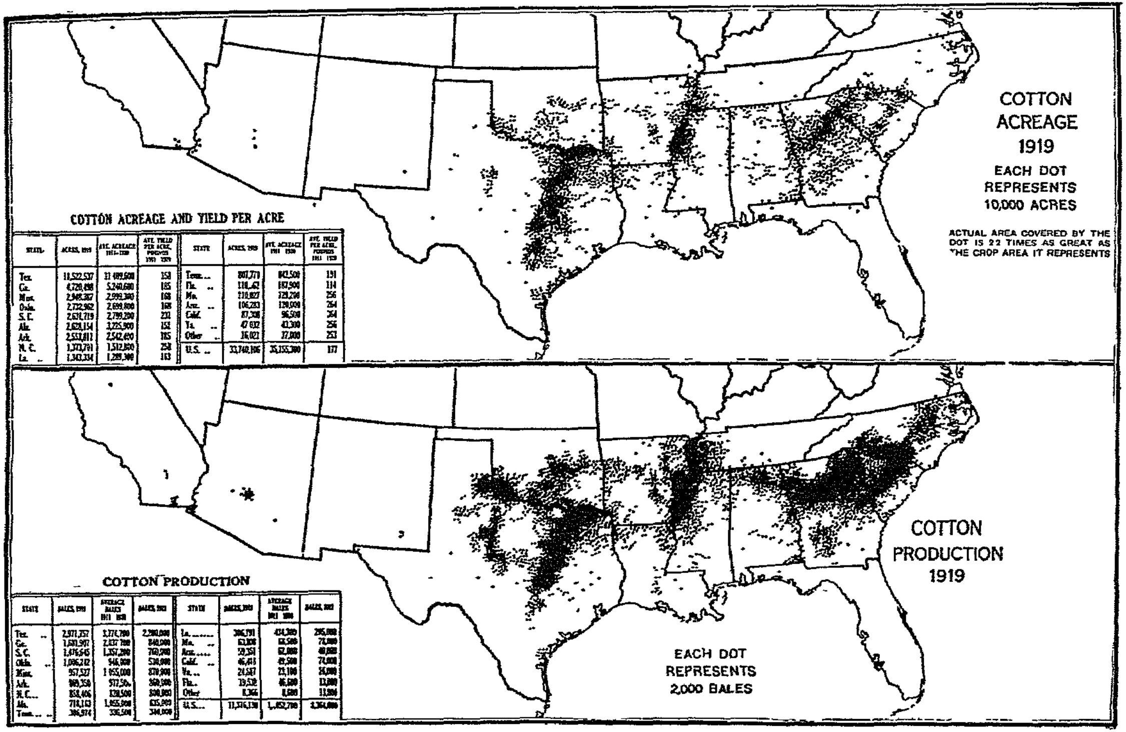
further inland where the greatest centers of cotton production are found (Fig 156) The small proportion of our cotton belt actually in cotton at one time shows great possibility of increased production In 1879, 20,000 square miles were in cotton. This was practically doubled in 1898, but by 1923 it had not reached one-twelfth of the total 700,000 square miles of possible cotton land It is thus evident that the cotton output can be increased several fold while other crops can also be largely grown in the same belt

Method of growing. The cotton seeds, about the size of a small pea, are planted thickly in rows in March and April As soon as the plants are established, they are thinned with hoes, after which frequent cultivations with the plow or cultivator are needed to keep down the weeds and to break up the top soil to stop evaporation

The picking of the fiber, which has thus far baffled all machinery, must be done by hand. Because the cotton does not all ripen at once, the field must be "picked over" several times before the crop is all harvested. The large amount of work involved makes picking the limiting factor in cotton growing. Owing to the light nature of the work, much of it is done by women and children.

The cotton-growing industry has been seriously threatened by a voracious insect, the cotton boll-weevil. It came to us apparently from Mexico and its young destroy the crop by tunneling through the unopened boll and blasting it. The damage has amounted to hundreds of millions of dollars, but a compensating feature is that it is forcing the South to develop a more diversified agriculture for which it has very great resources. The ease with which the grower's cotton crop, keeping indefinitely, easily handled, and king of money crops, could be mortgaged, and the great difficulty of mortgaging any other crop were factors in the establishment of the great crop-mortgage system in the South after the Civil War.

This mortgage system still continues to some extent and has been an important factor in the continuance of a one-crop agriculture in which very few supply crops are grown, so that even the hay eaten by the mule that plows the cotton is often imported in bales from north of the Ohio or west of the Mississippi.



COTTON ACREAGE AND YIELD PER ACRE

STATE	ACRES, 1919	AVE. ACREAGE 1911–1920	AVE. YIELD PER ACRE, POUNDS 1911–1920	STATE	ACRES, 1919	AVE. ACREAGE 1911–1920	AVE. YIELD PER ACRE, POUNDS 1911–1920
Tex.	11,522,537	11,489,600	158	Tenn. ..	807,779	842,500	191
Ga.	4,720,498	5,240,600	185	Fla. ..	118,462	187,900	114
Miss.	2,945,387	2,999,300	168	Mo.	110,027	128,200	256
Okla.	2,732,962	2,699,800	168	Ariz. ..	106,283	120,000	264
S. C.	2,631,719	2,799,200	231	Calif.	87,308	96,500	364
Ala.	2,628,154	3,225,900	152	Va. ..	47,032	43,300	256
Ark.	2,553,811	2,542,450	185	Other ..	16,021	37,000	253
N. C.	1,373,791	1,512,800	258	U.S. ..	33,740,106	35,155,300	177
La. ..	1,343,334	1,289,300	183				

COTTON PRODUCTION

STATE	BALES, 1919	AVERAGE BALES 1911–1920	BALES, 1921	STATE	BALES, 1919	AVERAGE BALES 1911–1920	BALES, 1921
Tex. ..	2,971,757	3,776,700	2,200,000	La.	306,791	434,300	295,000
Ga.	1,681,907	2,037,700	840,000	Mo. ..	63,008	62,500	78,000
S. C.	1,476,645	1,357,200	760,000	Ariz.	59,351	62,000	40,000
Okla. ..	1,006,242	946,000	530,000	Calif. ..	46,413	49,500	70,000
Miss.	957,527	1,055,000	870,000	Va. ..	24,587	23,100	26,000
Ark.	869,350	977,500	860,000	Fla. .	19,532	46,600	13,000
N. C. ...	858,406	838,500	800,000	Other	8,366	8,600	13,000
Ala.	718,163	1,055,900	635,000	U.S. ...	11,376,130	[illegible]	[illegible]
Tenn.	306,974	336,500	340,000				

FIG. 156.—The densest areas on the map are where the richest soils are found (United States Dept Agr)

The man who advances the money to the cotton grower does not encourage the growth of other crops, nor the development of a more rational agriculture, because no other crop is so easily mortgaged, so easily kept, or so readily salable as cotton. Thus the South, which has excellent natural facilities for the development of live-stock industries and the growth of forage crops, continues (in some parts) to import mules, hay, corn, butter, cheese, and pork, which it might produce as cheaply as any other part of the world, if not more cheaply (see chapter on live stock).

Important cotton districts. Cotton is grown from Norfolk, Va., to Austin, Texas, and up the Mississippi to Memphis (see Fig. 156), but three localities with unusual soils stand out conspicuously. One is the rich, black prairie of Texas, another the so-called Mississippi "bottoms," a term chiefly applied to the alluvial land to the east of the Mississippi River between Memphis and Vicksburg, which is occasionally fertilized by the mud deposited when the river overflows its banks and floods the whole region. The third district in which the natural fertility of the soil suffices to make cotton unusually important is in Georgia and Carolina where two wide belts of fertile clays are separated by a strip of less fertile sand. The center of cotton production has steadily moved to the west during the last seventy years. As the boll-weevil came on from the west cotton production fled eastward before him. Now that the weevil is all over the cotton belt, Texas still produces more cotton than any other state.

Kinds of cotton. The fibers of the ordinary upland cotton, the chief product of the United States, are a little less than one inch in length, but a variety known as Sea Isle cotton, considered the best in the world, has fibers as much as two and one-half inches in length. This produces a superior thread and commands a high price for use in the manufacture of fine fabrics. Sea Isle fiber is chiefly grown along the low sandy islands (barrier beaches) off the coast of South Carolina and Georgia, and seems to require heavy rain, much moisture, and the slightly saline soil and air of shore districts. It also does fairly well for some distance inland in southern Georgia and northern Florida.

Because of the dry climate, Egyptian cotton is superior to our own for knit goods, and for this reason the United States imports from 150,000 to 350,000 bales each year, an amount greater

than our total cotton consumption of 1830 Within the last few years it has been found that the conditions of the lower Colorado basin in California and Arizona, because of the great similarity of climate, produce cotton that is quite the equal of that of Egypt The Egyptian area is strictly limited by irrigation, as is our own The production of Egyptian cotton in America rose to 100,000 bales in 1920, and some of it was grown in the great valley of California

Probable improvements in America. The boll-weevil gave the industry a great shock, but hundreds of keen minds are fight-

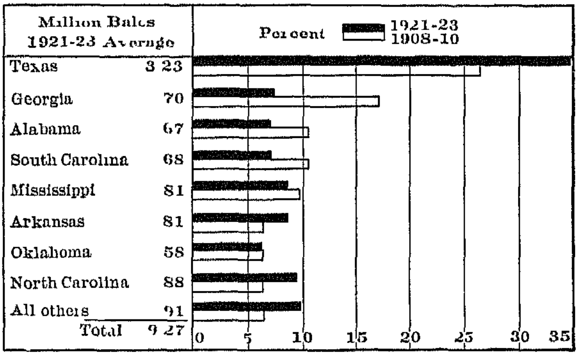


FIG 157 —United States cotton production, three-year average

ing him with poison, new varieties of cotton, and natural enemies. With the continued rapid spread of more scientific agriculture, with crop rotation and animal husbandry in the cotton belt of the United States, the production can probably be increased several fold during the present century The invention of a successful cotton-picking machine, for which inventors continually strive, would work a great revolution by removing the greatest labor element in its production and putting it nearly on a par with wheat, oats, and corn, in all of which crops machinery has made possible the working of many acres by a single individual The cotton gin brought great emancipation to cotton growing, but cotton picking still depends upon human fingers. This alone restricts the possible production to a fraction of what it might be with a successful machine picker. The stimulus to the

breeding of early maturing varieties of cotton, produced by the boll-weevil outbreak, is likely to permit the northward extension of cotton growing in this and other lands

By-products from cotton. The cotton seed, one of the most nutritious of substances, was for a long time thrown away, or even burned. Later it was returned to the fields as fertilizer. Then came the discoveries that the oil in which it was so rich could be extracted by heavy presses and put to many and rapidly increasing uses The manufacture of cotton-seed oil is now an important industry throughout the South. Over 4 million tons of cotton seed are now crushed annually, the crop of 1921 bringing \$30 per ton to the grower A ton makes from 36 to 40 gallons

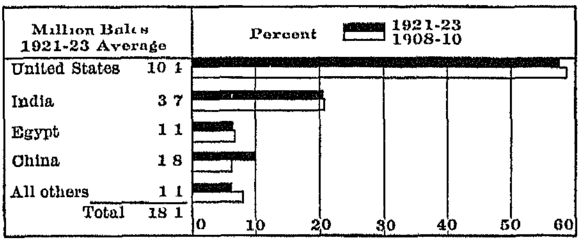


FIG 158.—World's cotton production, three-year average.

of oil The manufacture of lard substitutes now consumes from 85 to 90 per cent of the cotton-seed oil It is also refined and used as a salad oil. It resembles olive oil in food value, but unlike olive oil, it becomes rancid when exposed to the air for a few weeks The great richness of the cotton-seed meal in proteid, of which it is now the cheapest available source, has led to its utilization as food for dairy cows, for which it is shipped to every important center of butter and cheese production in the United States, Canada, and Europe. Its satisfactory use as a breadstuff for human food rich in proteid has been demonstrated, but humans change their diet much more slowly than cows do.

2. Manufacture and Trade in Cotton Cloth

Spinning and weaving in the hand-labor era. Fibers of any sort, when twisted around each other, tend to cling together and

form a thread, string, or rope Cotton, being a flat hollow tube, has unusual spinning qualities Primitive peoples in every continent have some method of spinning, also devices for weaving. For ages thread laboriously spun by hand was woven into cloth in hand looms, the industry being carried on in the homes of the workers even when the product was intended for sale Some people were spinners, others did the weaving, and cloth making

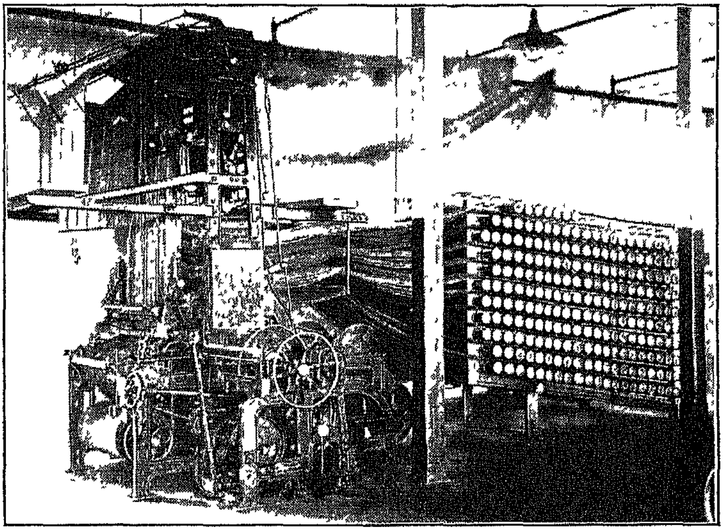


Fig 159 —A modern loom Spools of yarn to the right Cardboard patterns overhead at left Roll of finished cloth near floor at left (Crompton Knowles Loom Works, Worcester, Mass)

for sale was a common household by-industry throughout the western world in the middle of the eighteenth century Late in the eighteenth century three machines revolutionized the clothing industry of the world and also the history of the United States and of England One invention demands and usually produces another The spinning machine (1764), by providing more yarn than could be woven by the older methods, demanded weaving machines (invented 1787) (Fig 159), and the weaving machines in turn demanded more cotton In answer to this demand came

the cotton gin (1793), which, as we have seen, greatly increased the production of the raw material, six years after the power loom had made cotton scarce. Cotton quickly became cheap. This combination of spinning machines, weaving machines, cheap cotton, and the coal and the iron resources of England, enabled that country to forge rapidly ahead in cotton manufacture especially while all the continent of Europe was disturbed with the turmoil of Napoleon's wars. In 1785, the export of cotton goods from England was worth a million pounds sterling (about 5 million dollars), in 1815 it was 22 million pounds, and during this period it increased from 5 per cent of British exports to 38 per cent.

That short period of thirty years produced greater change in British industry than many previous centuries had made. It has been well called the Industrial Revolution, and, like inventions, machines, and styles, it has spread and is spreading to many countries. Before this revolution, man used little artificial power and the manufacturer often lived in the village or in the country where he gardened, kept some live stock, and worked on near-by farms. He was near to the food supply and had opportunity to use his extra time to good advantage. Industry was organized around a man's time. After the Industrial Revolution, the worker found himself living in a city tenement to be near his steam-driven machine in the big factory. Industry was organized around a machine, *a machine's time.* Man was away from the earth, the one great resource. He had no chance to produce food in his odd moments and was dependent upon the factory wage and imported food. As a result England's people have suffered some physical degeneration.

It is entirely erroneous to think of the machines of modern manufacturing as having completed their evolution. Mechanical improvement is going forward as rapidly now as ever, and to this improvement the textile industry is no exception. The completed modern cotton mill is large and often costs more than a million dollars. While one plant often completes the process, it is still a characteristic of the cotton-manufacturing industry that the yarn is made in one place and the cloth in another, as was done in the days of the wheel and hand loom. Thus, England is sending yarn to the Far East to be there woven into cloth;

Japan and India are sending yarn to China, the mills of Massachusetts are sending yarn to Philadelphia, and the mills of Philadelphia are sending yarn to Rhode Island, while a wagon carrying yarn from mill to mill is a common sight in every cotton manufacturing city All this means a waste of effort and consequently higher prices for cotton goods than necessary

Present distribution of cotton manufacture. During the nineteenth century, cotton factories spread to many countries, and cotton cloth has traveled to the ends of the earth The spinning wheel has disappeared before steam-borne commerce in ever-widening circles, until now it lingers only in exceedingly remote locations, where it continues, not because it is impossible to transport cotton cloth, but chiefly because it is impossible to send out any product with which to pay for it In the United States, the old method still persists in a few places in the Appalachian plateaus of eastern Kentucky and North Carolina

Relation of cotton manufacture to density of population. The world's cotton mills produce many varieties of cloth, from the coarsest to the finest, and the distribution of the factories making different kinds is an admirable illustration of the effect of dense population upon manufacturing industries. A pound of raw cotton may, with much fabrication, become several dollars' worth of the best machine-made lace, or it may become a yard or less of coarse, heavy cotton duck Several times as much labor and capital are required to produce the finer of these two products, even if machine made, while if the lace is made by hand it takes vastly more labor than that required for machine lace Brussels has been the center of the world's hand-made lace industry for the natural reason that it has been the metropolis of the most densely peopled nation Much of the lace is made by the Belgian peasants in the intervals of their farm work—a means by which they retain the great advantage of the domestic system—steady employment.

The United States has an instructive distribution of the industry into regions of coarse and fine production The average annual consumption of raw cotton per spindle in the South in 1880 was 155 pounds, in 1905, 119 pounds, and in 1919, 104 pounds In Massachusetts it was 72 pounds in 1905, 59 pounds in 1919, while in England it was 40 pounds. The cloth of the

southern cotton mills was and is therefore much coarser than the British or the New England product Speaking broadly, the South is, in its cotton cloth, exporting primarily its raw material. New England and Old England are exporting primarily their labor The product of the Middle Atlantic states, as might be expected, is midway in fineness between that of New England and the South

In the United States the manufacture of cotton is concentrated in the region east of the Appalachians, in a long belt from

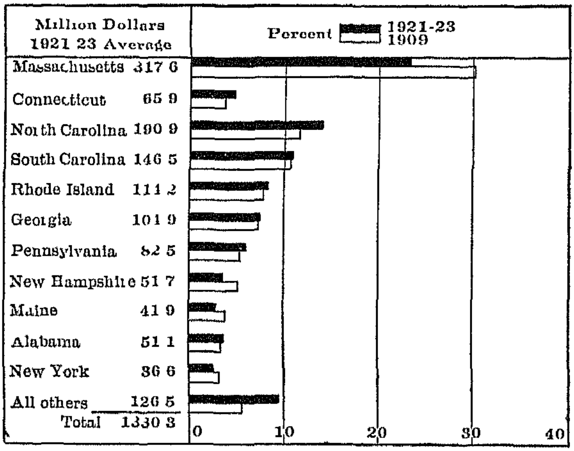


FIG 160 —Value of United States cotton manufactures, three-year average.

Maine to Alabama, with its greatest centers in New England and at the eastern base of the Appalachians in the Carolinas and Georgia, with a lesser center in Philadelphia (Fig. 160). New England, with 18 million spindles, leads in cotton manufacturing although the southern states with 16 million spindles are already consuming more cotton in a single year than does New England. During the decade from 1909 to 1919 the number of spindles in New England increased 14 per cent while in the cotton-growing states they increased 42 per cent New England is making the finer and more valuable fabrics, and seems likely to retain this specialty

The leading cotton-manufacturing city in the United States is Fall River, Massachusetts, where the little Fall River tumbles

down to the sea and develops enough power to start the first mill. Being at a head of a bay, it has a good harbor and can take advantage of ocean transportation for the importation of cargoes of cotton, and of coal, which now drives practically all the machinery of the city, the water-power having long ago become insufficient for the many mills

Southern cotton manufacture. The cotton manufacturing belt of the southern states is located near the fall line which marks the boundary between the Piedmont district and the Atlantic Plain, and also in the Piedmont district, where it has been able to take advantage of many waterfalls. In Alabama it is close to the coal fields Its nearness to the raw product which is often grown in the immediate vicinity is an advantage shared by no other important cotton-manufacturing district in the world. But owing to the fact that freight rates are usually less on raw than on finished products, this is a questionable advantage for the southern cotton mill when manufacturing for other localities.

It was the cheaper labor that was the chief factor in locating cotton manufacture in the South The Appalachian Mountain district had a white population, dense in relation to the resources, and therefore with inadequate opportunity for employment, so that wages were much lower than in the North and West So when the cotton mills gave an opportunity for profitable employment these mountain people migrated in large numbers to the mills just as the people of Quebec and Europe migrated to the mills of New England

The South with its product of coarser cotton sheetings and cloths, a product requiring a large amount of raw material with a small amount of labor, has entered more largely into supplying our exports than has any other district, because coarse uncolored cloth constitutes the chief bulk of our exports Our best cottons stay at home and our export is consumed in largest quantities in countries where, like China and Africa, the coarse cloth is desired by a poor population China alone has in some past years taken the greater part of our entire export of cotton goods, and we furnish the scanty raiment (loin cloth, 3 × 10 feet) for some of the tribes of Africa

Cotton manufacture in other sections of the United States. Many English textile workers have settled in Philadelphia, where

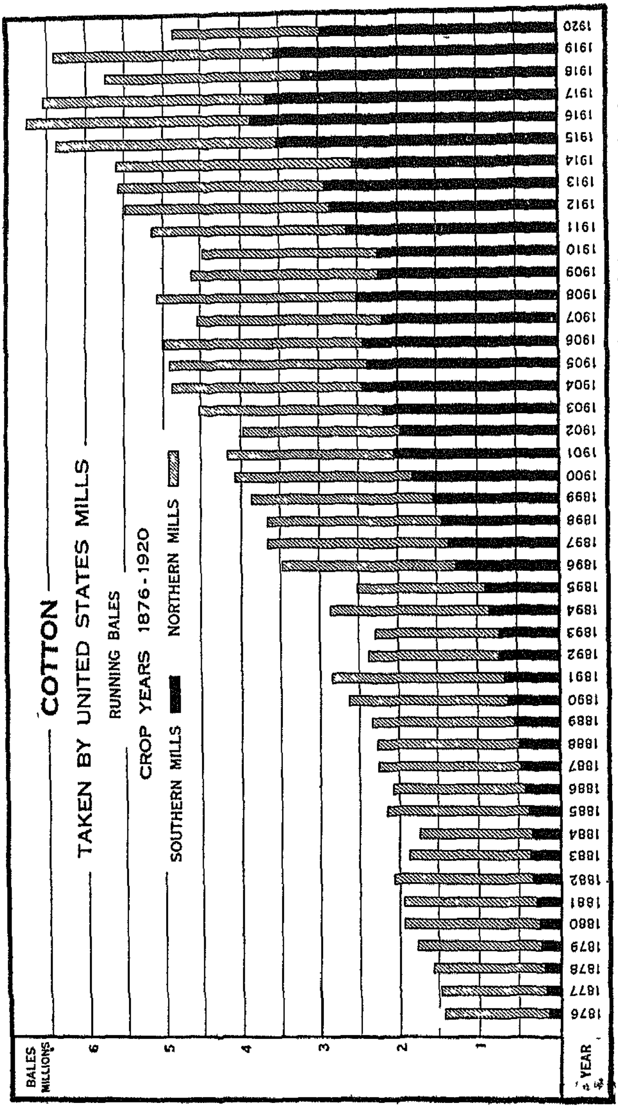


FIG 161 —Is thus the handwriting on the wall for the Northern mill? (United States Dept. Agr)

their imported skill has made possible the introduction of textile industries that had not previously flourished in America, such as lace, hosiery, tapestries, chenilles, and other cotton goods that require skill in coloring

The dependence of the textile industry upon labor more than any or all other factors has caused the amount of cotton manufactured west of the Alleghenies to be very small, and it is not increasing very rapidly

3 The Wool-manufacturing Industry

Wool and its qualities. Wool was originally the under coat of the sheep Many animals have an outer coat of coarse hair with a shorter warmer coat under it. The seal skin of commerce is such an under coat On the sheep this under coat has the character we call wool, and by long breeding and selection sheep have come to have a coat which is chiefly wool, although this animal also has some hair and in some hot countries it has hair only, like a deer or cow Wool differs from hair and other fibers in being crinkly or curled, so that it makes an elastic cloth, and also in being covered with minute scales, whereas hair is smooth These scales overlap each other as do shingles on a roof, and when the natural grease is scoured from the wool, the scales catch each other and hold the wool together as a tangled mass This quality is utilized in making a matted threadless fabric called felt, produced by beating, shaking and rolling the fibers together This felting process is also used in making hats, both soft and hard

Woolen clothing is the best for cold climates because it prevents the escape of heat of the body, permits the moisture of perspiration to pass through and yet does not become wet so easily from rain as do fabrics made of other fibers

The process of manufacture. The fleece as it comes from the sheep has grease and other impurities which amount to half or three-fourths its total weight It is washed to get rid of the loose dirt, scoured to remove the grease, combed and carded to get rid of other foreign substances and to lay the fibers out straight ready for spinning the yarn for final weaving into cloth In its relation to household industry and the industrial revolution,

wool manufacture is like cotton and the other textile industries, except that it is older and much more widespread than cotton manufacture.

Woolens, worsteds, and shoddy. The term "woolen goods" as used in the trade, includes only those woolen fabrics which do not show upon their surface the intertwining threads of ordinary woven goods Woolens are woven but the fact is hidden by a process called "fulling" in which the cloth is beaten to give a felting effect and finally the fibers are pulled up by being gently combed with teasels so that the surface has a uniform, smooth, almost furry appearance The chief woolen fabrics are broadcloth, cashmere, tweed, blankets, flannels and shawls "Worsted goods," made of woolen yarns, show upon their surfaces their woven origin and are gaining in popularity over woolens "Shoddy" is thick, warm cloth made of remanufactured wool fibers obtained by tearing up tailors' clippings and woolen rags, mixing them with new wool, and weaving all into a warm, cheap cloth.

Wool manufacture in the United States. In the United States we see the effects of the colonial importance of the woolen industry, for its manufacture is the most widely scattered of all the textile industries. Small mills, comparable to the rural grist mill and driven by small waterwheels on insignificant streams, were established in the last half of the eighteenth and the first half of the nineteenth century over almost all the settled country, and small factories are to be found to-day in every state of the Union, athough in many of them the output is insignificant The large-scale manufacture of modern type, with big factories, is concentrated east of the Alleghenies, north of Maryland, in an almost continuous belt reaching from Wilmington, Del, and southeastern Pennsylvania, through northern New Jersey, southeastern New York, and lower New England into southern Maine. These factories, like the modern American wool industry, have largely arisen since 1865 In this concentration of the wool industry, we see another example of the dependence of textile manufacture upon dense population, the valuable wool of Montana, New Mexico, Ohio, and distant foreign countries being carried thousands of miles to the place where abundant labor exists to manufacture it. Philadelphia

is the greatest single woolen manufacturing center in the United States, but almost every city of importance in this eastern belt has woolen mills.

About 500 million pounds of wool were required by American mills in 1919, we import from one-third to one-half of what we use (Fig 162) Eighty million pounds of wool are also re-used in making shoddy. The declining importance of wool is indicated by the fact that the woolen mills of the United States recently used in one year 46 million pounds of cotton to mix with the wool

Carpets and hats. Wool is important in carpet manufacture, but only inferior carpets are made of pure wool The better

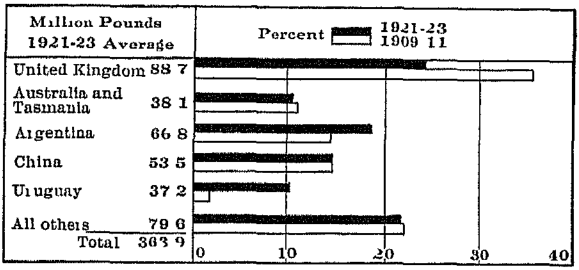


FIG 162 —United States import of raw wool, three year average.

ones, such as Wilton, Axminster, and even Brussels have a strong web of linen or hemp into which the wool is woven Philadelphia has long been noted as the great carpet manufacturing center of the United States and although the carpet industry there is steadily growing, the increase of carpet mills in some northeastern cities has caused Philadelphia's share of carpet manufacture to decline from nearly a half to about two-fifths.

Hats are classed with wool manufactures, but they are made chiefly by felting rather than weaving. The usual material is the hair of fur-bearing animals, especially rabbits. The fur of the beaver is used for the finer "top" hats. The coats of domesticated hares and rabbits of North France and Belgium were formerly the mainstay of the American hat industry, but in 1923 Australia and New Zealand furnished well over half of the imported skins and fur. This branch of the American woolen

industry amounts to over \$50,000,000 a year, of which nearly one-half is paid for the furs. Hat manufacturing is chiefly centered in the district between Danbury, Connecticut, and Philadelphia, with New York, Connecticut, and Pennsylvania producing four-fifths of the output.

The limitation of raw materials. Wool, like leather, is scarce and becoming more so with small prospect of adequate increase of supply to meet increasing population. Wool is largely a by-product of the meat industry, and the conditions of the wool manufacturing cannot affect the raw material supply so directly as cotton manufacturing can affect its raw material, since cotton is a product grown for its own sake. A 25 per cent increase in the price of wool, say from 24 to 30 cents per pound, amounts to 30 or 40 cents increase in income per sheep per year—a factor of small importance. A similar increase in cotton, from 20 to 25 cents per pound, changes the entire basis of the business and causes great increase of output, for the cotton grown to meet the new demand would be on the market in a year or even less, while the wool resulting from a desire to increase the output would have to await the maturity of animals yet unborn. The cotton and wool industries have, therefore, fared very differently in the past 25 years. While cotton production and manufacture have been going up by leaps and bounds, the production of raw wool throughout the world has increased but little, and has at times remained stationary or even declined. The world's production of wool has remained about 3 billion pounds over the past ten years. As a result, cotton has been substituted for wool in many of its uses. If the process of substituting other fibers for wool does not continue, we are likely to have much higher prices for wool, because of the large amount of land needed to produce it.

The industrial awakening of China and Japan, and their adoption of western ideas and methods, will increase rather than diminish the world scarcity of wool. They had worked out very efficient and satisfactory clothes of cotton and silk and have been foolish enough to adopt western styles of clothing. European styles demand wool, and Japan, with practically no wool supply, is beginning to import (60 million pounds, 1922) and manufacture some foreign wool. China is now exporting her

small crop of wool because the native styles of clothing can be supplied by cotton and silk, chiefly cotton The adoption of western styles of clothing by modernized China may be expected to produce a demand for wool in that country. These oriental changes of style are likely to be permanent in contrast to the seasonal changes that beset the world trade in clothing, especially woolen clothing

Substitutes for sheep's wool. The other animal hair fibers used for fabric seem destined to continue in a very secondary place—as the alpaca wool with its resulting fabric, the Cashmere goat's hair with its fabric Mohair, the fleece of the Angora goat, native of the province of Angora in central Asia Minor, shows well the process of invention and substitution Its main use is for plush, as for car seats, but of late it has been used to make imitation fur of such appearance that detection is difficult.

4 SILK

The United States leads in silk manufacture though we do not produce a bale of the raw material We import raw silk from the other side of the world, a fine example of the labor factor in locating industry A freight rate of 3 cents per pound is less than one per cent on raw silk and the same freight is from 150 to 200 per cent on wheat valuation The freight is, therefore, an almost negligible factor in sending silk halfway around the world from the place with the most desirable conditions for the production of raw silk to the place with the most desirable conditions for its manufacture Thus it easily comes from countries with very cheap labor (see chapter on Japan)

One-third of the total value of silk production is expended for the raw silk which is furnished to the United States as follows. Japan about two-thirds, China one-fifth, Italy one-twelfth (Fig. 163).

Relation of silk manufacture to other industries. Silk manufacture is comparatively light work, and the percentage of women operatives in the silk mills is higher than in any other branch of textiles This predominance of women gives the silk mill a tendency to be what is sometimes called a "parasitic industry", that is, it is located because of the presence of other in-

dustries which employ large numbers of men, so that the wives and daughters of the workmen make a labor supply which encourages the starting of silk mills. Paterson, N. J., an important place for the manufacture of various classes of iron goods, which employ only men, has for this reason long been the most important silk-manufacturing town in the United States, having produced over a quarter of the total silk product in 1890 and about a fifth in 1919. This relation of the silk to heavy industries is well shown in Pennsylvania, where the silk mills are located chiefly in and near the coal-mining towns, especially Scranton and Wilkes-Barre, and the cement-manufacturing towns of Allentown and Easton in the Lehigh Valley, and in the agricul-

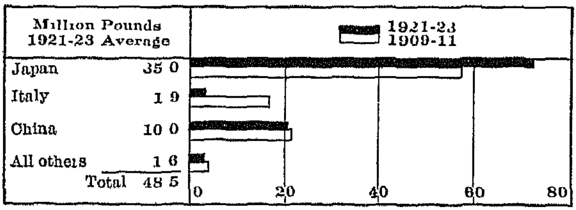


FIG 163.—United States imports of raw silk, three-year average

tural-implement-manufacturing town of York, and more recently in the coal and iron region of western Pennsylvania.

Artificial silk. The silkworm makes silk by drawing the fine threads from a jelly-like mass in its head. This material is made from the cells in the worm's vegetable food, as changed by the chemistry of its body. Man has copied the worm's process. By the chemistry of the laboratory, sawdust or cotton waste may be converted into a jelly much like that from which the caterpillar makes its silk. By air pressure this cellulose is driven through very small apertures in glass and wound by machinery. Each aperature makes filaments so small that, as with silk, it takes ten to twenty of them reeled together to make a thread. This process, which began in France, has spread to Germany and Switzerland, England and America. The American output is increasing with a suggestive speed. In 1913 the output of artificial silk was one and one-half million pounds, and in 1922, it was 25 million or over one-half as great as that of real silk. It

should be noted that this fiber, still perhaps in its infancy, is made chiefly from cotton, an abundant raw material

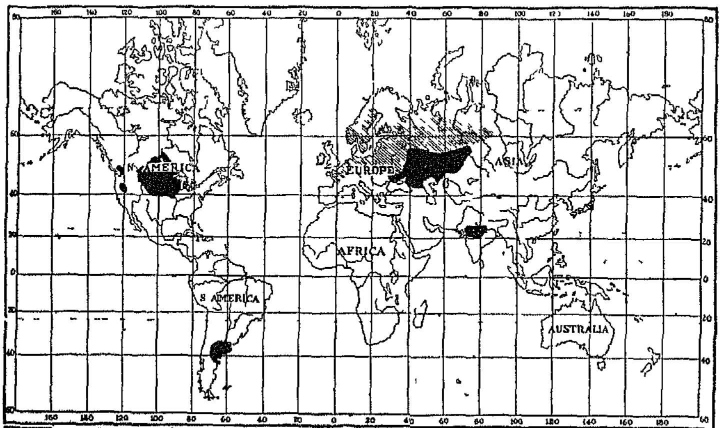
5. The Plant Stalk Fibers

Practically all the larger plants have stalk fibers some of which are of good quality for textile use if they could be secured in cheap abundance, and several dozen kinds of such fibers are actually in extensive use in various parts of the world This group of fibers is of unknown antiquity and because of gin-cheapened cotton it has probably been of less relative importance to man in the last century than in any century for thousands of years It has been displaced for the time being, but there is no guarantee of the continuance of cotton's leadership in plant fibers Some stalk fiber cheapened by machinery may compete with it, but just at present the use of plant stalk fibers is at a low ebb, despite their superiorities over cotton.

Flax and its preparation. Flax is now, as in the past, the most important plant stalk fiber entering into our clothing This plant, a member of the nettle family, has to our certain knowledge been yielding linen since the pre-historic Lake dwellers inhabited the Swiss lakes, and the mummies, bound up in linen cloth, were placed in the Egyptian tombs four or five thousand years ago In 1790, when cotton was less used in manufacture than China grass or ramie now is, flax was the most important of all vegetable fibers. It was grown on almost every European and American farm, and in many an old American home the implements for the preparation of flax are still to be found. The introduction of cheap cotton caused the disappearance of flax from gardens at nearly the same time that the spinning wheel and the hand loom disappeared from homes.

The fiber as obtained is from 8 to 50 inches in length, strong and durable, but since the coming of cotton, the labor of getting it out of the stalk has made its production impracticable wherever wages were high and the import of commercial products easy. Thus linen is limited to special uses for which it is peculiarly fit, as collar and cuff manufacturing This is one of the most important American industries using linen, and this branch of manufacture shows a most astonishing concentration in the

city of Troy, New York, where nine-tenths of the entire product of the United States is made. This concentration is best explained by the fact that, if a new collar and cuff factory is to be established, the best place in which to find labor already trained for the work is in the city of Troy (It is stated that the wife of a Troy blacksmith first made shirts with detachable collars about seventy-five years ago, and that a Methodist minister encouraged



Cultivated primarily for seed production, straw not used for fiber, except to limited extent in Russia and Siberia

Cultivated primarily for fiber, straw used for fiber and seed for oil except in Ireland where seed is usually not saved

FIG 164.—Distribution of flax in cultivation (Original by Lyster Dewey.)

this home industry See R. H. Whitbeck, *Journal of Geography*, Oct, 1909)

The range of the flax plant and the flaxseed industry. Although flax produces a valuable seed (linseed), the plants grown for fiber are pulled before they blossom so that flax fiber districts have no valuable by-product of seed as is the case with cotton growing Flax thus gives rise to two industries: one, fiber, the other, grain The plant has an exceedingly wide range, having produced good fiber all over the eastern United States and in Europe from Scotland, Sweden, and Russia to Italy. The cultivation of the flax plant for its fiber, like silk culture, shows fine responses to labor conditions—density of population (Fig 164).

Varieties producing poor fiber but fine seed are grown in several of the important wheat regions, as Argentina (one-half of the world's crop), Central Russia, the spring wheat belt in the United States and Canada, and northern India. In all these districts, with a total crop of 110 million bushels (pre-war average), flax is, from the agricultural standpoint, not a fiber but a cereal planted like wheat, harvested with the most improved reaping machinery, threshed by steam, and handled in every respect like wheat with no thought of saving the fiber that is in the straw Indeed, the straw is often burned The laborious hand processes of harvesting in sparsely peopled countries like Dakota and Argentina are entirely impossible, but fit well into the scanty opportunities of north Russia where the Archangel district produces most of the flax fiber The export of flax fiber from Russia fell from 60,000 tons before the World War to 20,000 tons in 1922. The only significant increase in flax growing since the war has been seed flax in Argentina. The two Dakotas and Minnesota produce nine-tenths of our crop of 12 million bushels.

The seed, upon being crushed, yields linseed oil, much used as a raw material for the paint and varnish factories of Philadelphia and other eastern American cities. The "oil-cake" that remains is highly valued as food for live stock, and is shipped from Dakota by way of New York, Montreal, Boston, and Philadelphia to feed the herds of dairy cows in Holland, Denmark, and England

Possible fiber revolution. Inventors are striving for two goals either of which may make a revolution resembling that of the cotton gin One is a successful cotton picker and the other is a machine or process that can get the fiber from flax straw cheaply. The same applies to ramie or China grass (see next page)

Hemp. Hemp, the fiber of common cordage, is closely allied to flax, of which it is really but a coarser variety and therefore fitted for coarser uses The bulk of the world's commercial hemp came from the flax districts of Russia before the war Italy produces the highest priced hemp fiber. It is imported into the United States for commercial twine, coarse toweling, and carpet yarns.

American hemp has for a long time had a declining output

due to the competition of cheaper labor in other hemp-growing countries, but especially, through the competition of cheap jute A little hemp is still grown in Wisconsin, California, and Kentucky.

Ramie, one of the best of the oriental plant fibers, is much used as a substitute for linen Ramie and China grass are the same thing at two different stages of manufacture, China grass being the name for the rough brown fibers, which are called ramie when bleached out. The fibers are very strong, ramie having the longest individual cells of any fiber plant. When woven the cloth is fuzzy in appearance, and when properly dyed it holds colors well It makes excellent embroidery and bobbin lace.

Ramie thrives best in temperate climates where the danger of frost is at a minimum It is grown all through central China, and Swatow prepares more ramie for market than any other city. The de-gumming process is not difficult and the Japanese in Taiwan have in operation a successful decorticator. Ramie is spun in each of the Japanese linen mills, and there are in addition some successful ramie mills. In the Orient ramie is in wide use, and it has possibilities of becoming a flax substitute and possibly to some extent a cotton substitute in the western world.

6 CLOTHING

Similar development of the textile and clothing industries. At the end of a century and a quarter of machine manufacture and world commerce, the making of clothing passed through an evolution similar to that which has occurred in the textile industries. The cloth was at first made in the homes of the workers from materials which were given out on contract Later the whole work was done in the large factory with the aid of machinery. Some clothing is now made by the old domestic system, some on contract in the homes of the workers, and some in factories and shops, with the factory made product gaining on the others

The first decade of this century was, as a consequence, a period of rapid increase in the manufacture of men's and women's ready-made clothing in factories rather than in sweat shops In the sweat shop five persons usually work on a coat, each doing a particular part. In some of the great factories, as many as a hundred persons work on each coat, and the total amount of

time required to produce a given output has been reduced to one-third or even to one-tenth of that required before the introduction of the greater division of labor, new cutting machines, and the electric-driven sewing machines.

Clothing manufacture belongs to large cities (Fig. 165) because of the double advantage of nearness to labor and to market. It is an advantage to be near the center where the product is sold, and the successful selling of ready-made clothing requires a market where vast numbers of persons are supplied, so that, by the law of averages, all of each of the many sizes of clothing may be

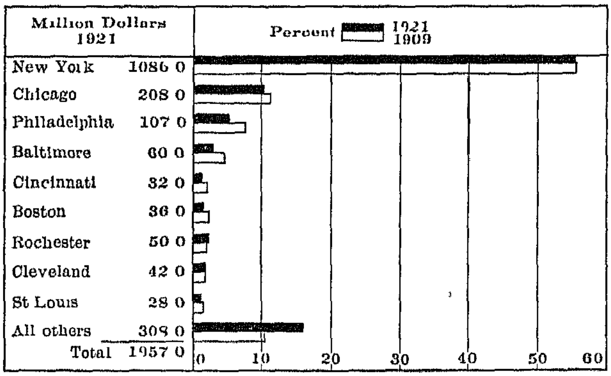


FIG 165 —United States clothing manufacture by cities.

called for As the market widens, it permits the finer and finer subdivision of the sizes, and the greater possibility of an exact fit for each person The large city also possesses the labor which is so large a factor in this industry with raw materials and finished product so easy to transport. The manufacture of clothing has become concentrated to an astonishing degree in the city of New York, the greatest distributing center of the United States, where it is the leading industry, with an output valued at over a billion dollars per year and equal to that of all the other cities of the country. Chicago is second, Philadelphia third, Baltimore fourth, Rochester fifth, Cleveland sixth, and Boston and Cincinnati next in order This great predominance of New York grew up in large part because of the unusual labor condition that exists because it is the chief place for the landing of the

new immigrant. Tens of thousands of these people know nothing of the language and little of the country, and they are accustomed to low wages and inexpensive standards of life. The clothing factory, where each person does a small operation, offers these helpless ones an opportunity to acquire in a few days the skill to make a better wage than they had in Europe, so they herd together in the cities. In one block on Broadway, New York, covered with twelve-story structures, 40,000 people were engaged in manufacture, largely clothing, in 1910. No other city block in the world could rival this as a human hive but it is no cause for pride. The industry in all the American centers is usually carried on by foreign-born persons newly arrived in this country.

The standardizing of clothing is steadily advancing and with it new additions to the list of manufactured articles. Thus the small tailor is suffering from the competition of the great factory through the competition of made-to-measure mail-order business. By this innovation, a country merchant in Texas shows a book of samples to a customer, measures him, and the suit is made in a New York, Rochester, or Chicago factory.

There appears to be no reason why standardized clothing, like shirts, overalls, etc., could not be made to better advantage in small country towns where comfortable and wholesome living is cheaper than in the big city. Some such development seems to be starting in southeastern Pennsylvania.

Questions

1. How does the commercial excellence of cotton help to make poorer the man who grows it?
2. Will a heavy increase in demand for clothing fibers be met equally by increase in wool or cotton?
3. What would be the influence upon clothing supply of a successful cotton picker?
4. Is Alabama with plenty of cotton and coal a good place to start a mill for the manufacture of the finest cotton goods made in America?
5. The silkworm and the mulberry tree upon which it feeds both do well in Indiana. Is it a good place for the production of raw silk?
6. Does the modernizing of China have the same effect upon the world supply of wool and silk?
7. Explain how the supply of fibers is in an unstable condition.
8. How did the European war which was then in progress destroy the value of the 1914 cotton crop? How did it affect the value of corn? In this instance,

show the particular advantage enjoyed by the Southern farmer who rotated his crops? What are some of the other advantages of crop rotation in cotton lands?

9 How has the boll-weevil outbreak stimulated the breeding of early maturing varieties of cotton?

10 Why has the cotton-manufacturing industry not advanced west of the Alleghenies?

11 What changes of style in the Orient may stimulate sheep raising in America?

12 Explain how freight charges are an almost negligible factor in the cost of raw silk

CHAPTER XII

LEATHER AND RUBBER

I. RAW MATERIALS AND MANUFACTURE OF LEATHER

Hides and skins. Leather is made by cleaning and treating skins so that they will keep, and the skins are furnished by a great variety of animals. Naturally the domestic animals—the ox, sheep, goat, horse, and pig—lead, but many other animals, including sharks and alligators, contribute their small quota.

Leather is as old as trade and the industry contributes to the commerce of every nation and every people, sometimes in the form of hides and of raw materials for tanning, sometimes as finished leather, which is the raw material of shoe factories and other leather works, and finally in the form of shoes and other leather manufactures.

The term hides is applied to the skins of cattle and horses, skins, to those from sheep, goats, and smaller animals. The United States leads in the manufacture of leather, making as much as all the other countries of the world combined, and the import of hides and skins, amounting to over $100,000,000 a year, is one of the greatest items of our foreign trade. Practically every country in the world contributes some of these raw materials, and of goat skins alone we import over a hundred million a year. We get hides and skins from sparsely settled countries like Argentina and Uruguay that do not have large tanning industries. We also get them from the crowded manufacturing nations of the world—England, France, and other European countries, where the fuller utilization of resource, due to a dense population, has produced a scarcity of tanning materials in which the United States is the richest country in the world.

Tanning processes and materials. Tanning usually consists in treating the skin with a strong astringent, tannin, a very common vegetable substance which unites with certain elements in the hide and changes it from a material prone to decay, to one of

great durability. Tannin, like sugar, is widely distributed among plants, and has long been found in workable quantities in all continents Tannin is secured from many parts of the plant, as myrobolans, the dried fruit of a leguminous tree from India, valonia, the cup of an acorn in Turkey and Asia Minor, the sumac leaf from Sicily and Appalachia, and also from wood itself, as is done in the chestnut extract mills in the forests of both Europe and America, and of quebracho wood from the Gran Chaco in South America.

Until a half century ago, the peoples of Europe and America depended for tannin chiefly upon the bark of oak in southern,

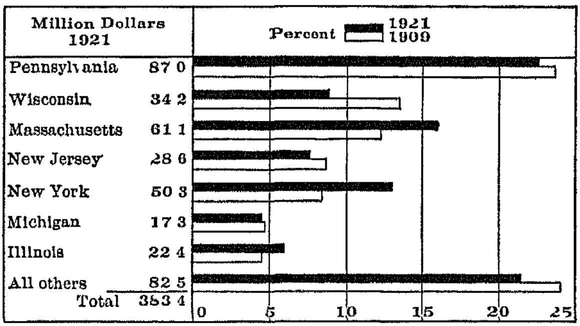


FIG 166—Leather tanned, cured and finished in United States.

and hemlock in northern, locations. The growing scarcity of forests and the increased supply of hides which world commerce produced, has created a lively trade in other tannin-producing materials, so that now no less than fifty of them are in use With the increase in distant commerce there is a growing tendency to ship these materials in concentrated forms or extracts, thus lessening transportation costs

The chief part of tanning consists in scraping the skins to get rid of all flesh and fat and then soaking them in liquids strong with tannin or other tanning material

The United States makes nearly $400,000,000 worth of leather per year (Fig 166). While still importing small quantities ($11,000,000 in 1922) of special European makes, the United States had a leather export of $45,000,000 in 1922. The indus-

try, which gives employment to 80,000 people, is one that has undergone greater changes in material than in method. The forest with its bulky bark determined the location of the American tanning industry until the end of the nineteenth century. The valuable hides and leather were easily portable. Tanneries were often small affairs like the little country grist mill, and were scattered in rural hamlets, and mountain valleys throughout Appalachia and New England.

We have two bark-tanning belts, one reaching the whole length of the Appalachian Mountains from New York to Georgia and including Virginia on the east and Tennessee on the west, the other in the hemlock region running from Massachusetts to Wisconsin, both of which are important leather states.

Chemical tanning and its effects. Fortunately for the forest resources of the United States and the world, a new tanning industry has arisen practically independent of vegetable materials because it depends upon chemical compounds of chromium. This chrome process was first developed in Philadelphia, where it has grown with great rapidity and has helped to make that city the greatest leather-manufacturing center in the world. Philadelphia's specialties are patent and enamel leathers and vici kid. The chrome leather industry, depending on factory products, labor, and markets, tends to locate in manufacturing centers rather than forest districts and since it depends almost entirely upon imported goatskins for its raw material, there is some advantage in being near the ports of entry which are often near to shoe manufacturing districts. Some kinds of leather must still be made with bark.

2. Leather Manufactures

Leather manufactures include belting for driving machinery, harness, and finishings for automobiles. It is also used for a host of small trinkets and many industrial purposes (Fig. 167), but the making of boots and shoes is much the most important use.

During the first half of the nineteenth century shoes were made by hand all over the country. During the last quarter of the nineteenth century factories began to roll out shoes through the aid of very complex machinery, and a minute division of labor,

in which many persons worked on each shoe. The passing of the roadside shop was followed by a surprising concentration of manufacture. New England, with her lack of natural resources but abundant labor supply, early developed shoe manufacturing and now makes half of America's total output. The state of Massachusetts makes more than twice as many shoes as any other state The two cities of Brockton and Lynn lead in production while Haverhill, and Boston are other important shoe centers Manchester, New Hampshire, and Auburn, Maine, are really a part of the same shoe district, which sends shoes to every state in the

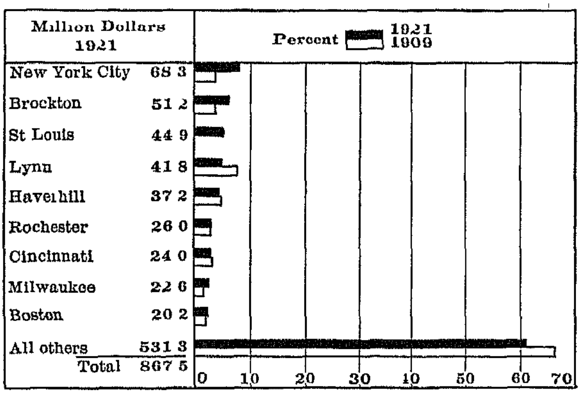


FIG 167 —Boots and shoes manufactured in leading cities of the United States.

Union and to many foreign countries. As with the ready-made clothing, so with ready-made shoes, a wide market and large sale make possible the production of a great variety of shapes and sizes so that greater and greater proportions of the people can be fitted with the factory product. This factor in combination with the smaller cost [1] of machine-made goods in comparison to hand output, helps to explain the great and quick concentration of the industry.

The foreign trade in shoes seems destined to be small The

[1] One of the few make-to-measure shoemakers remaining in Philadelphia has to charge $24 a pair for men's French calfskin shoes, but they have great durability

superior fit and comfort of American shoes is appreciated and a few years ago a large trade seemed to be in prospect, but the export of American shoe machinery to Europe has been followed by the ability of Europeans to compete in quantity production and American shapes This, in combination with preferential tariffs, has cut down the American shoe export to European countries United States shoes find their best market in the neighboring countries of Cuba, Canada, and Mexico, though smaller quantities are shipped nearly all over the world. In connection with shoe export, the tropic habit of going barefoot should not be overlooked Shoes are almost unthought of by races that buy cottons by the million yards. Many nations that buy nearly all their cotton and woolen goods make nearly all of their shoes The Indian who wears store clothes often prefers and makes his own moccasin (or has his wife do it)

Tendency of shoe industry to spread. High freight rates and the heavy expense of shipping a bulky though valuable commodity like shoes help to explain the rise of new centers nearer the western markets New York City now ranks first in shoe production, St Louis is fourth, and Rochester, Cincinnati, and Columbus, Ohio, have growing industries

Glove manufacturing in the United States. While many fine gloves come from France, Germany, and England, there is a production, chiefly for home use, of something like $20,000,000 worth in this country. The glove industry is remarkably concentrated, the two towns of Gloversville and Johnstown, in Fulton County, New York, neither of which has 20,000 people, making nearly half of the gloves in the United States. These towns, founded by Scotch glove-makers, had the advantage of an early start, and the electric sewing machine makes the glove a home industry.

The future supply of leather. There is no sign of any lessening in the demand for leather As standards of living rise, the people of Holland, Belgium, and Germany tend to lay aside wooden shoes, as do the Chinese and Japanese their leatherless foot-gear of straw, cotton, and wood But leather is rising in price because it depends on the supply of animals, and animals are now becoming relatively scarce and must continue so if people keep on increasing The world does not possess the leather to

make western shoes for the Chinese. In the United States, which draws upon the world, the number of hides and skins used increased 15 per cent between 1909 and 1919, and their cost increased 165 per cent Leather substitutes should be welcomed.

3. Furs

Furs comprise a branch of the leather trade that tends to go down rather than up as the population of the world increases. This is because nearly all the furs are taken from wild animals many of which are carnivorous As a further limiting factor most of them live in forests and the forests are being cut and burned. Thus the woods of our two northern forest belts are the chief home supply of furs, but the chief part of the world's product comes from the great sub-arctic forest that practically girdles the world from southern Alaska to Labrador and from Norway to Kamchatka. Throughout this vast and frosty region the wandering trapper annually makes deep journeys into the wild forest and emerges at the end of weeks or months with a bale of fox, muskrat, mink, martin, beaver, otter, sable, and other skins In 1915 the price of furs went to almost nothing, because of the war, and the manufacturing of steel traps at Oneida, New York, suddenly stopped In 1919 fur prices soared during the postwar speculative boom In 1921 they slumped with dull times Fur farming, which has at last begun in a small way in Canada (see chapter on Canada) is in response to a keen and normally increasing, but fluctuating, demand

4. Rubber

The origin and utilization of rubber. While primitive man long ago learned to use the tannin from many plants, the rubber that many other plants contain had to wait for modern man with his laboratory

The coagulation of the sap of trees into a sticky or gummy substance is a familiar occurrence, and the sap of many tropic trees produces the chemically complex substance we call rubber. For 80 years it was used only as an eraser. Then the various experiments of MacIntosh and Goodyear, mixing rubber with sulphur, made it suitable for waterproof clothing, shoes, and

boots A large percentage of sulphur makes the hard rubber used for combs and a great variety of electrical and industrial articles

Sources of rubber. Our crude rubber supply has followed the age-old course of man's progression from the hunter stage to the grower stage. Until a decade ago the major part of the world's rubber was obtained from the wild rubber trees found chiefly in the upper valley of the Amazon River Rubber hunters ascended the river in boats, and after locating a hundred or more trees and cutting paths to them through the dense tropical jungle, tapped them for the latex, or rubber milk, which was laboriously coagulated on paddles by smoking it over wood fires in the forest.

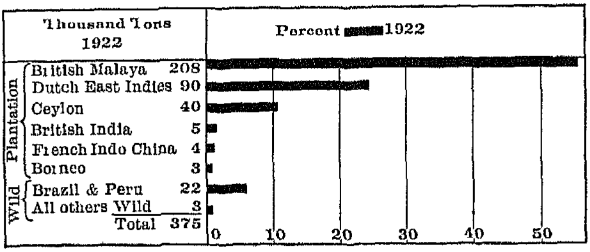


FIG 168 —World production of plantation rubber and wild rubber.

The methods of the industry were primitive, the product was uneven in quality, and the facilities for getting the balls of rubber to market were poor. The wild rubber trees of Brazil, Peru, and a few other scattering tropical countries never produced much over 50,000 tons of rubber annually, but this relatively small amount was quite sufficient for the needs of the world before the arrival of the automobile

In 1876 an English scientist carried seeds of the rubber tree from Brazil to England, whence the young rubber plants were taken to Ceylon and later to Malaya and the Dutch East Indies The transplanting experiment was successful, and rubber plantations, financed by British capital and worked by coolie labor, were established in the Far East. The rubber trees were set out in rows like fruit orchards, and in about seven years grew to tapping age. In 1900 the output of the plantations was 4 tons of crude rubber, while 54,000 tons of wild rubber was marketed,

by 1922 plantation rubber had grown to 350,000 tons, while the wild supply had decreased to 25,000 tons (Fig 168) In the short space of two decades, cultivated rubber had increased from practically nothing to the point where it supplied nearly 95 per cent of the world's needs and the price had gone from one or two dollars per pound to 20 cents or less per pound. Despite the enormous increase of automobiles there was overproduction of rubber and the price went below cost of production. Plantation rubber is usually of more even quality, and the curing is better than that of the forest-smoked product. The

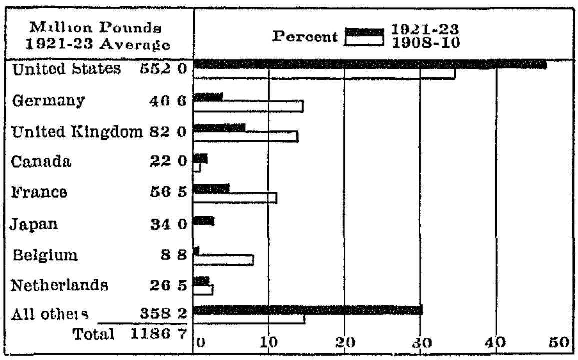


FIG 169 —World's rubber import, three-year average

rubber market of the world has shifted from Para, Brazil (which gave its name to the finest grade of wild rubber), to Singapore, a world port on the Malay Peninsula.

The manufacture of rubber. Although crude rubber is a product of the tropics, its manufacture is largely confined to American and European cities of the north temperate zone, where most of the finished products are used The art of rubber-making has progressed far since the inventions of MacIntosh (1823) and Goodyear (1842) made possible the first waterproof clothing, shoes, and boots, and modern factories now unite with laboratory skill to give us an ever-increasing number of useful articles The fundamental process remains the same, however, raw rubber is mixed with sulphur and then heated to bring about the chemical change known as vulcanization. From 2 to 10

per cent of sulphur is added to make soft rubber, while over one-third sulphur may be added to make the hard rubber used for combs and a large variety of industrial products.

The increasing use of rubber in America is shown by the import figures, which have risen rapidly from less than 5,000 tons in 1870 to 309,000 tons in 1923 Rubber footwear, the earliest of our rubber industries, is produced to a great extent in the same states which make our leather boots and shoes, and is still a large user of the crude product. Rubber hose is a universal necessity, filling a thousand uses; the air-brake system of every train requires it Rubber packing in engines, pumps, and valves, and rubber electrical supplies show how universal is the distribution of manufactured rubber, which goes wherever steam goes and water is lifted

The use of rubber which at present dwarfs all others is that of automobile tires and inner tubes The 18 million cars and trucks of America travel on 72 million tires which are constantly being worn out and replaced, and it is estimated that this growing industry uses four-fifths of America's present rubber import The rubber industry had an early start in Akron, Ohio, and with the tremendous growth of the automobile industry since 1910, has had a remarkable concentration there, the twenty rubber companies of Akron using one-third of all the rubber consumed in the world. The United States is the largest exporter of tires and other rubber goods

The future of rubber. Already our rapidly growing rubber industries take over six pounds of rubber per capita for all the 110 or more million people in this country. Future increase in the automobile business will cause increased rubber demand, and the chemist is constantly finding new uses for it. The cheap plantation rubber is already dominant in the market, but the scientific improvement of the tree is yet in the experimental stage Rubber trees will be selected to yield larger returns, as was the case with the sugar beet, and grafted as is the case with most commercial fruit orchards The number of profitable rubber plants may be increased.[1] While the best rubber trees can be grown nearly everywhere in the tropics, there is a limiting factor —labor. Plantations in the British and Dutch East Indies have

[1] In the days of high-priced wild rubber Mexico had a thriving industry based on the semi-desert guayule shrub, dug up and ground up for the extraction of rubber. The rubber glut from Malaya killed this industry dead

succeeded because they have available a large supply of cheap labor to clear the forest, tend the trees, and gather the latex. Skilled Chinese rubber workers in British Malaya are paid 34 to 57 cents per day, while the Indians, Javanese, and Malays get from 17 to 28 cents per day for unskilled labor. (Commerce Reports, Dec. 9, 1918.) Asia, Africa, South America, and the

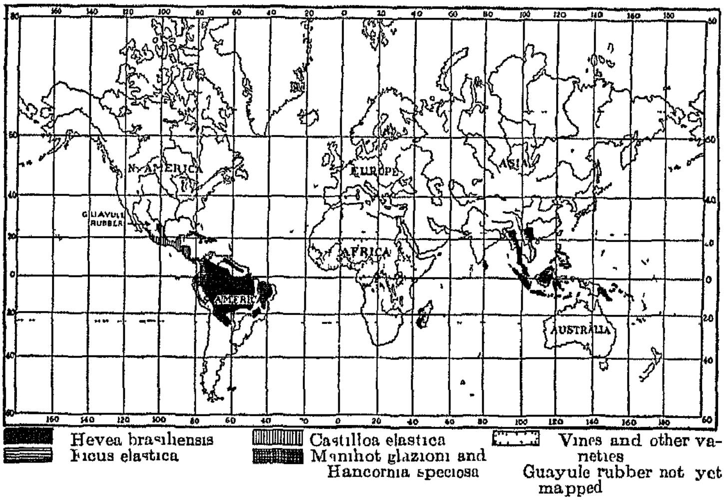


FIG 170 —Distribution of leading varieties of rubber plant. (From A. Vincent, *Indrustries du Caoutchouc et de l'amiante*) Few products are produced by so many plants over so much of the earth's surface

Philippines, with huge areas of jungle in every way suitable for rubber growing, will be able to compete with Ceylon and the Malay Peninsula only if they can obtain a sufficiently cheap and well-trained supply of workers

The chemists have also succeeded in making synthetic rubber in the laboratory, although it has not yet been reduced to an industrial basis.

QUESTIONS

1 Where should a tannery be located?
2 From what kind of countries do we import hides and skins?
3 Explain how an invention revolutionized the rubber industry
4 Compare the prospects for cheap rubber and cheap hides
5 Explain why wild rubber is decreasing in importance

CHAPTER XIII

THE MACHINERY, SHIP-BUILDING, AND METAL INDUSTRIES

I FACTORS OF LOCATION

Ship-building must be done where the ships can be launched, but the location of other classes of machine building is influenced by two factors which often tend to conflict, but which sometimes coincide—labor and the market It is easy to see how a carload of iron, steel, or wood is much less bulky than the same materials made up into machinery. It is therefore a transportation advantage to have the factories located near to the market rather than near to the raw material. In some classes of machinery, such as cheap and bulky agricultural machinery, the transportation cost is heavy in proportion to the value, and the dominating influence of the market is strong. So, Chicago, in the midst of the great wheat and corn fields, has the main plant of the International Harvester Company, the greatest maker of farm machinery in the world. In other classes of machinery, such as clocks and watches, the freight element in the cost to the ultimate consumer is relatively small and the labor element is large, with the result that the labor element has strong influence in the location of the industry Waterbury, Conn., and Waltham, Mass., have thus maintained their watch and clock factories in the East, where, for decades, their workmen have been trained

The manufacture of machinery for factories is nearly always a sort of second stage in industry, the first stage being the growth of the industry which uses the machinery, thus developing the market for it Heavy machine manufacture tends to develop near each particular industry using that machinery Philadelphia and Worcester, Mass., make textile machinery and Denver heavy mining machinery.

machinery together have given the world cheaper food and raw materials than it ever had before.

The census of 1920 showed astonishing changes due to agricultural machinery Within 20 years the rural population of Ohio, Indiana, Illinois, and Iowa had declined 7 per cent, (Fig 171). This was due to the use of machinery which increased over 300 per cent in value per farm It was accompanied by an increase of 6 acres in the size of the average farm, and a decrease in the number of people per farm Where it can be used agricultural machinery removes man from the land (Fig 172),

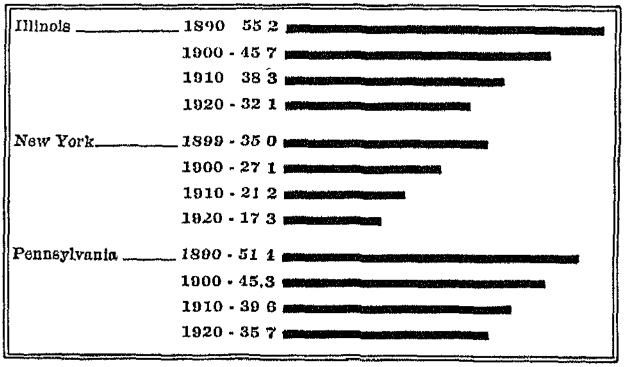


FIG 172 —Rural population· per cent of totals The supply of machine-made agricultural products has combined with the factory lure to cause a steady decline in the proportion of our population that lives on farms

as shown by a population of seventy-one persons per 1,000 acres on the best level Ohio land and seventh-four per 1,000 acres on the poorer hilly lands of southwestern Ohio.

Manufactured near the market. Agricultural machinery is very bulky, and the consequent high freight rates give a great advantage to the factory located nearest to the place where the machinery will be used. Therefore, this industry has always kept close to the edge of the great farming region, especially the grain belt. For a time the leading center of manufacture was in the city of Auburn, New York, then Columbus and Springfield, Ohio, on the edge of the vast level plain of the corn belt, which has been the compelling force in making men use farm machinery

With the further westward movement of the market, the industry centered in Chicago, the greatest agricultural market and the greatest railway center in the world. Chicago's leadership is due to her location in the heart of the corn belt, the hay belt, and the oats belt, and also near the wheat regions. These influences have made Chicago's manufacture of agricultural implements five times as great as that of any other city in the country.

The westward trend of the industry is shown by the fact that Springfield, Ohio, once the second city in importance in implement manufacture, has recently been surpassed by Moline, Illinois,—a town on the banks of the Mississippi River distinctly to the west of the important manufacturing part of the United States. Peoria, Illinois, and Richmond, Indiana, are other important centers.

Interchangeable parts. The manufacturing of agricultural implements has received a great impetus from the practice of making machines with interchangeable parts, so that one machine in the factory turns out one piece which will fit any one of thousands of a given kind of completed machine in the field. This enables the farmer in any land to feel independent of the location of the factory and to take advantage of the fact that the American machines have been adjusted to the various kinds of lands that exist in the United States or elsewhere. Thus we send machines of the so-called "stump jump" types to the newly cleared Australian "Bush."

The combination of patents, adaptation, and low prices gives us one of the few branches of foreign trade in which America has outstripped foreign countries which have cheaper labor and approximate equality of raw materials. American agricultural machinery is much used in Argentina, Russia, Canada, and Australia, countries with conditions much like our own.

The wagon industry has an economic kinship with farm implements. Wood and iron are the raw materials in both, both are relatively bulky when completed, and, therefore, need to be made near the market, which is located primarily in the same region. Every farmer must have one or more wagons. The fitness of the North Central states for leadership in both industries is therefore explained.

The deciduous trees or hard woods (see chapter on Lumber) furnish nearly all our wagon woods. Second-growth hickory, which was picked out by Peary to make the sledges for his dash over the Arctic ice fields towards the north pole, is one of the monopolies of the United States. This wood, unrivaled for strength combined with elasticity, grows from New York to Georgia and Missouri, and is used for making the spokes and hubs of wagon wheels.

The manufacture of wagons has gone through the process of concentration similar to that which has occurred in the shoe and textile industries. Two generations ago the country blacksmith and wheelwright had their shops side by side. One did the woodwork and the other the ironwork, and they manufactured wagons for their neighbors, while the shoemaker next door made the shoes and the tanner at the foot of the mountain made their leather. As shoe machinery has replaced the shoemaker, so automatic woodworking machinery has displaced the country wagon-makers whose hand-made product can no longer compete with the cheaper product of the factories in the North Central states, which send their output to every state and county in the Union, and, in limited amounts, to foreign countries.

3. Automobiles

The automobile industry, although only thirty years old, has already assumed vast, almost revolutionary, proportions in the social and industrial life of America. The first automobiles were made in France in 1891. A year or so later the United States adopted the new form of locomotion and has since developed motor car manufacture so successfully that in value of product it now ranks as our third industry. Over 400,000 workers are directly dependent on it for their livelihood while a still greater number get a living from it indirectly. From a plaything and a luxury the motor car has become a necessity, especially in rural America, where its use has made living conditions easier and more pleasant for millions of farmers. The widespread use of automobiles has given America one for every seven people, while in France, the second largest automotive manufacturer, there is one to each 93 inhabitants. In 1924 the United States

had 18 million motor vehicles registered, or 83 per cent of the world's total of 21 million.

Location of the industry. Motor car manufacture is not a new industry in the strictest sense but rather a successor to the American carriage industry The United States produced nearly one million carriages in 1904, but only 22,000 automobiles, while in 1923 the output was 10,000 carriages and 4,000,000 automotive vehicles It was natural for the carriage makers of the middle west to take up the manufacture of this new kind of carriage, and many of our present-day automobile factories are a continuation of well-known carriage and wagon factories. The lower lake region is a natural manufacturing district, with its nearby iron and coal, its supply of hardwoods, and its good water and railroad transportation The great dependence of the automobile factory upon other factories and machine shops gives it a strong tendency to cluster around recognized centers In the automobile area, which includes the cities of Cleveland and Akron, Ohio, Flint and Lansing, Michigan, Indianapolis and Chicago, Detroit has become the unchallenged leader The rapid increase of the automobile and its allied equipment and parts industries in Detroit has tended to make it the most favorable place in the country for a new automobile industry to locate

Mass production and low-priced cars. While this country produces some of the finest and most costly of motor cars, its greatest achievement has been in standardization and mass production, with its resulting low prices The early cars, and to a large extent those which are made in Europe to-day, are built individually, each part ground and tooled to fit its particular fellow. By the extensive use of automatic machinery, American factories began to make standard wheels, axles, bolts, nuts, bodies, and engines, all so alike that any part will fit any other The parts are turned out in indefinite quantities and the cars are put together by the use of a belt conveyor. The moving belt or floor passes between rows of workmen, each repeating his small part of the speedy and endless assembling performance As the growing car moves along piece after piece is bolted on, an assembled engine is dropped into place, a gasoline tank and a seat are added, and at the end the completed car rolls off the

belt, ready for its trial run (Fig. 173). The Ford factory, which is the leading manufacturer of low-priced, standardized cars, has increased its production by such cost-cutting methods, from 1,700 cars in 1903–04 to over 2 million automobiles, trucks, and tractors in 1923

Foreign trade in automobiles. While America has no monopoly on the mechanical and administrative skill requisite for mass production, our large home market plus the tremendous advantage of the World War assured us the lead of the world in automobiles, both for home consumption and for export American imports of motor cars have decreased until they consist of only a few high-priced and specially built cars On the other hand, standard makes of American low-priced and medium-priced cars are shipped all over the world and driven in every land Their popularity has been due to cheapness, efficiency, and in no small measure to ease of repair. The car owner in Argentina, Australia, or South Africa is not dependent on a machine shop for his repairs, but can usually obtain from his dealer a duplicate part whenever needed and make the repairs himself. Consequently our exports of automobiles and parts in 1923 were not only greater than all the rest of the world combined, but were second in value of all United States exports, being exceeded only by raw cotton.

4. Machinery for Manufacturing

The manufacture of machinery for manufacturing tends to occur near to the place where it is used Aside from the advantages of freights and transportation, there is a great convenience resulting from the increased ease of running back and forth to see that specifications are carried out and repairs promptly delivered There is yet another reason. Improvements in machines are most likely to be conceived by people who use and repair them and watch them while they work

Textiles, our oldest modern industry, give ample illustration of these factors in the location of their machine supply industry. The bulk of the English textile machinery is made in Manchester, Bolton, Oldham, Accrington, and Rochdale, all of them in the Lancashire cotton district. As this district has led the world in making cloth, so it has led the world in the export of textile ma-

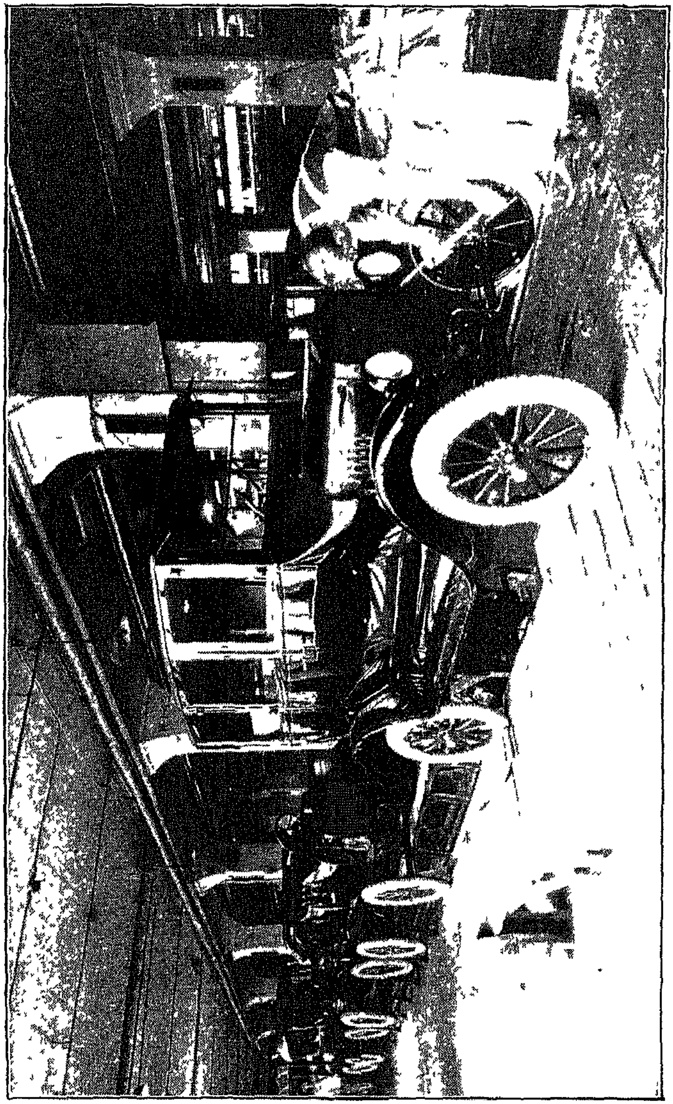


Fig. 173.—Fast operation in a motor car assembly Note the endless chain conveyor on which the cars are carried forward. (Ford Motor Company)

chinery, in which Britain far exceeds all other countries together

Worcester, Massachusetts, near the center of the New England textile field, and Philadelphia with its many mills, are leading centers for the manufacture of textile machinery Other cities of southern New England, especially in Massachusetts and Rhode Island, share in this manufacture

Importance of machine tools. The machine tool is the keystone of machinery manufacture. It is a recent invention for the easy shaping of the wood and iron parts of the machinery upon which manufacturing depends The fashioning of wood and metal can be reduced to a few simple mechanical operations—planing, boring, turning, milling, and slotting, which have for ages been done by hand or by very simple mechanical aids For each of these operations large, heavy, expensive, but exceedingly efficient machines have been devised These mechanical units have been combined into a class of machines called turret lathes which perform a number of different operations by having tools arranged on a rotating wheel, each of which automatically comes in turn to do its part of a finished whole. Thus a rod will be made into a series of perfect bolts, nuts, or screws of exact dimensions and each just like all the rest That likeness is the great economic secret of this mechanical age These mechanical means produce the many parts which, upon being put together, make the complex, efficient machines of the modern factory.

Many of these machine tools have been improved to the point where they become automatic This condition is attained when a machine will take pieces of material and turn out a uniform product. Thus a roll of wire is fed into one end of a machine and finished wire nails or screws come out at the other

The manufacture of machine tools. The machine shop is the market for machine tools, and the machine shop is located where machinery is to be repaired or made It is plain that repair shops, even more than plants for new construction, must cling to the places where machinery is used. The machine-tool industry is therefore located by the machine users, and interesting responses of location result. It is plainly an industry without any great center In seeking its market it tends instead to scatter itself over the whole region of manufacture, with its greatest western centers

at such centrally located cities as Detroit, Cincinnati, and Cleveland. Hamilton and Dayton are also important points.

In the East, Philadelphia is a center for this line of manufacturing, because of the need of her textile mills, her engine factories, her locomotive works, and the shipyards of Camden, Chester, and Wilmington upon the Delaware Chicago, the heart of a rapidly increasing manufacturing district, is also rising in importance in the manufacture of machine tools, while New England is largely supplied from the cities of Worcester, Mass, Providence, Hartford, and New Haven.

Engines and motors. Engines or electric motors are used in almost all kinds of factories, and also in nearly all mines and on many farms Their market is not quite so restricted as that for machine tools, but their manufacture is located by the same factors and is distributed in the United States from Lake Michigan to the Atlantic and southward to southern Pennsylvania. The leading centers of manufacture are Milwaukee, Wisconsin, Pittsburgh, Philadelphia, New York City and environs, and Schenectady, New York, all of which have excellent transportation facilities

5. Machinery for Transportation

Railway cars. Transportation, which plays so vital a part in this country, employs an enormous number of people. The mere building and repairing of the two and one-half million freight cars employs more laborers than does the cotton industry in Great Britain, and the number of workers, 600,000, far outranks the 462,000 in the American cotton industry. The annual value of this work exceeds $1,900,000,000, an amount greater than the value of the product of the American blast furnaces. Although every railroad has repair shops scattered along its lines at junction points and at ends of divisions, this work is, so far as possible, concentrated in the best locations, Chicago, St. Louis, Pittsburgh, and Philadelphia being important centers

Locomotives. In the manufacture of locomotives, Philadelphia leads every other city in the world One plant there makes about one-third of the output of the country, and, with the assistance of plants at Pittsburgh and Scranton, gives to Pennsylvania one-half the entire output of the United States Philadelphia's leadership

is due to no one cause. It is an industry which, so far as the general situation is concerned, is almost equally at home anywhere between Chicago and New York. The Philadelphia plant has a unique labor organization, the city has excellent supplies of coal, is reasonably near the sources of iron, and being in a city of homes, has an abundant supply of workmen. The great locomotive works of Philadelphia have outgrown their city location and are gradually moving to a more roomy suburb on the bank of the Delaware. New York state produces one-fourth of the locomotives of the country, the most important center of manufacture in that state being the city of Schenectady, which also produces so much electrical machinery.

Few important industries approach locomotive manufacture in the extreme degree of fluctuation in prosperity. In periods of promising traffic and easy borrowing, the railroads order locomotives, and at other times they do not. The booming prosperity of 1906 resulted in the manufacture that year of 6,592 locomotives in the United States. After the panic of 1907 the output of 1908 fell to 2,342.

6. SHIP-BUILDING

How ships are built. The ship is the largest object that man can move, the most complex of all his devices, and the one with the most thoroughly correlated parts. The usual method of building a ship is to lay down its keel or backbone upon a series of inclined blocks (Fig. 175) called a "way," from which the ship is finally allowed to slide into the water when the hull is completed. As it lies in the water the masts and machinery are added and the finishing work is done. The method of ship construction shows the necessity of locating shipyards upon deep, quiet rivers with an abundance of available land along the shore. It is better that the ship-building river have fresh rather than salt water, because it is less injurious to the hull of the ship. All of the important ship-building localities are near to iron- steel- and machine-manufacturing districts.

Influence of different ship-building materials. The American ship-building industry has had its ups and downs, due partly to the influence of the change in building materials. From 1800 to 1850 the world's ships were wooden sailing vessels, for which New England, with her pine forest, not far from the oak supplies of the

Middle Atlantic states, had the best and cheapest material in the world. All along her coast, especially in Maine, many shipyards were turning out vessels that were better and cheaper than those built in Europe. About the middle of the nineteenth century it was discovered that iron ships were better for most purposes than wooden ships, and their use rapidly increased. Iron was later replaced by steel In the supply of the raw material for this new

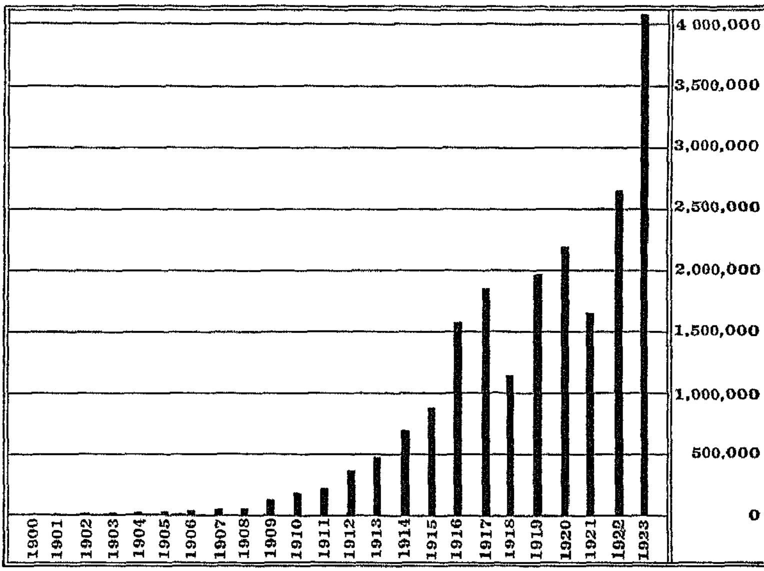


FIG 174 —United States production of motor vehicles, 1900–23.

type of ship, England, with her leadership in the iron industry, was far ahead of the United States

Within the United States similar changes occurred In the wood ship era before the Civil War the output of the New England yards was nearly twice that of the Middle Atlantic and Gulf Coast, but the latter, adjacent to iron and steel supplies, had twenty times the New England output in 1923

British leadership. Britain normally builds ten times as many ships as we do Her leadership since the latter part of the nineteenth century is due partly to cheaper raw material, partly to

cheaper labor, partly to abundant capital, the limitations of home opportunities, and the desire to invest in ships, and partly to the economy which comes from the great size of the industry In America and on the continent of Europe vessels are commonly built one or two at a time, but in the large shipyards in the British ship-building centers upon the River Clyde in west Scotland, the Tyne in northeast England, and the Irish harbor of Belfast, a half-dozen or a dozen steamers all alike are built at one time As each part is duplicated several times, the cost for each ship is less than when built singly During the World War Britain temporarily lost her ship-building supremacy to the United States, but peace-time adjustment has again made her the source of the world's shipping

The American industry is centered largely within a short radius of New York and Philadelphia The many yards at Brooklyn and other points upon the waters of New York harbor, make that one of the greatest single ship-building areas in America The Delaware, sometimes called the American Clyde, with yards at Philadelphia, Camden, Chester, and Wilmington, is the most important ship-building river in America.

Although the Pacific states produce practically no iron, the need of equipment for repair work and the building of battleships has caused the establishment of first-class, modern shipyards at San Francisco, Oakland, Los Angeles, and Seattle

Shipping upon the American Great Lakes renders great commercial service and its construction comprises an important part of our ship-building industry. As the vessels cannot leave lake waters, they are built upon the lake shores The most important centers are at Cleveland, Chicago, Detroit, and Buffalo

Ship-building during the war. The necessity of building ships fast enough to beat the submarine caused the development of a new type of ship construction in the United States during the World War By minutely standardizing the vessels and limiting them to a few types, the builders were able to use the machine shops of the whole nation, rather than remaining dependent upon works immediately beside the river bank. Thus a bridge plant in Pittsburg, a boiler plant in Ohio, a structural steel mill in West Virginia, and a plate mill in Illinois made hundreds or thousands of duplicate parts for hundreds of duplicate ships.

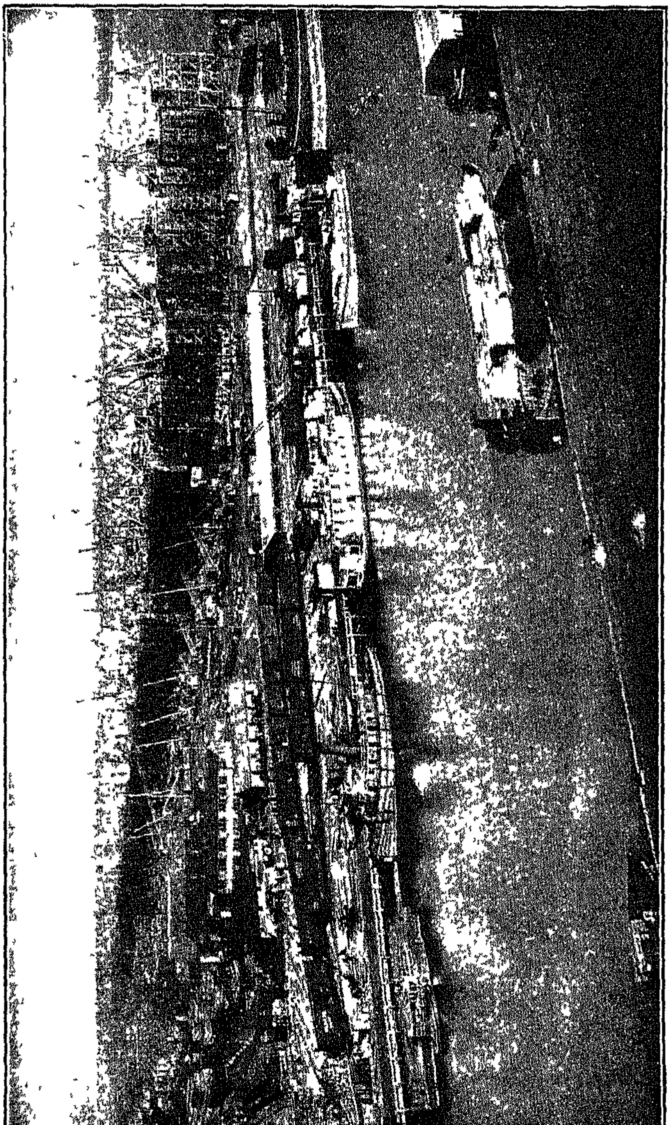


FIG 175.—Hog Island ship yard was built during the war and afterwards dismantled It was the largest shipbulding plant in the world

Before one of the best known of the fabricating yards was even done (see Fig 175), 49 steel works were making the larger parts for the vessels it was to build.

Like knock-down houses, parts of vessels were made all over inland America, delivered at the shipyards, and put together with all possible speed Reaming, riveting, and caulking were done by engine power, through the aid of pneumatic tools, and the various yards vied with one another in the speed with which their fabricated ships slid off the ways. A New York ship-build-

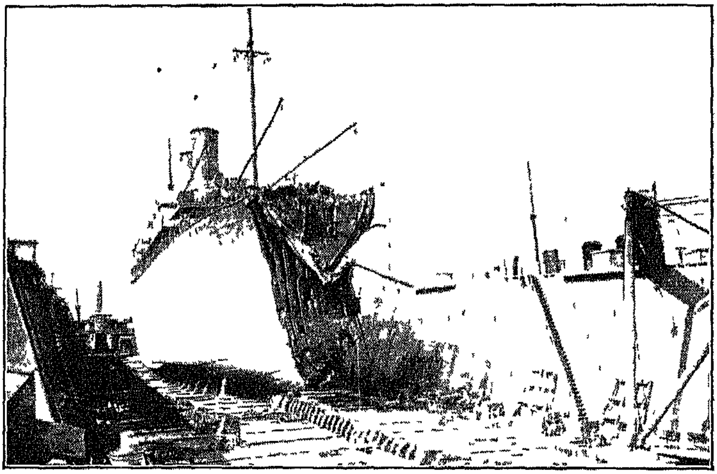


Fig 176—Steamer in dry dock at Fifty-fifth Street, Brooklyn, after collision off Massachusetts coast Steel construction preventing shivering of ship and water-tight compartments preventing filling and sinking Ships are sometimes built in dry docks like this one

ing company built the "Tuckahoe," a 5,488 ton vessel in 28 days from the time the keel was laid, and made another record by fitting it out in 10 days more The end of the war found the United States building ships much faster than a peace-time world needed them, so the huge shipyards, after finishing part of their contracts, were gradually dismantled. One of the results of America's war-time ship-building was to increase her merchant fleet of sea-going vessels from two million tons in 1914 to about 17 million tons in 1924, at which time hundreds

of ships for which there was no cargo were idly rotting in our rivers.

Standardization methods are not suited to the ship-building industry as a whole, but many of the economies learned during the war can be applied to the building of certain types of ships, such as oil tankers and freight carriers The more a vessel can be standardized, the more it can take advantage of spare parts and the less it will have to depend on costly individual repairs.

7 Small Metal Manufactures

Relation to good labor supply. An inspection of a hardware store reveals a collection of hundreds and even thousands of articles, such as saws, axes, cutlery, firearms and ammunition, plumbers', tinners', and carpenters' tools, and that very long list of articles known as builders' hardware, nearly all of which are made of metal. A jewelry store reveals a collection of still more valuable metal products in which, even more than in the hardware, the metal plays a relatively small part, and the labor a large part in the cost of production This high labor and small material value means that these articles are likely to be produced where population is abundant, as in New England, not where it is scarce, as in Virginia, Kentucky, or Iowa

The distribution of the industry. The manufacture of most of these small articles, in the making of which machine tools and automatic machinery are very important, particularly in America, originated in England and in Germany. It soon started up in this country, in southern New England, the home of the so-called "Yankee Notions," and has gradually moved westward through New York and Pennsylvania into the North Central states New England is holding a leading place by making more and more refined articles as regions farther west take up branches of the small metal manufacture Springfield, Mass, and Hartford, Conn., continue to be great centers for the manufacture of firearms and ammunition, and a large part of the jewelry made in the United States is produced within 30 miles of Providence. Rhode Island, being the most densely populated state, becomes a natural home for such an industry, in which labor is seen to dom-

inate when we consider that both the valuable raw material and the finished product can be transported so easily. Silverware has its center of manufacture in some of the towns of Connecticut, which state also leads in the manufacture of clocks and watches, especially the very cheap models.

Standardization and interchangeable parts. The New England clock business has been made possible by the American system of manufacture, in which standardization and interchangeable parts have replaced the old hand methods by which every clock was different. Switzerland has long been famed as the best watch-making country in the world, Geneva and vicinity being the center. These watches are made by hand, each wheel carefully fitted to the next wheel, so that if one breaks, the new one has to be shaped by hand to fit its mates. By the American method of interchangeable parts, fifty watches can be taken to pieces, each piece put into its own bin, and the watches may then be satisfactorily reconstructed by chance selection of the necessary parts. Thus, Connecticut can make alarm clocks and watches at fabulously low prices, because of new methods of manufacture, perfected largely through American inventions.

Apparently such industries can only be kept up by the continued improvement of the patterns and methods, for if an article, like a microscope for instance, falls into the class where it is a plain matter of labor and skill, it is made where skilled labor is cheapest. Thus America has never thought of establishing a wood-carving business. It belongs in Europe just as the still more difficult ivory carving belongs in India with its yet cheaper labor, and as silk production belongs in China and Japan with the cheapest of all labor. Indication of the adjustment of industry to population is shown by the pre-war complaints of German makers of cheap clocks, that Japan was selling them in China at prices no European manufacturer could meet.

Questions

1. Compare Kansas City as a place for the starting of an agricultural implement factory and a jewelry factory.
2. What is the influence of farm machinery on the number of farm population?
3. How has the environment made the United States lead Germany in the production of agricultural machinery?

4 Why does Germany lead the United States in the manufacture of microscopes?

5 Do the wagon and automobile manufactures have the same degree of concentration?

6 When automobile sales are good, what other industries benefit, directly or indirectly?

7 Explain some shifts of the ship-building industry due to inventions

8 What effects did the war have on ship-building?

CHAPTER XIV

CHEMICAL MANUFACTURES

Chemical action. Squeeze a few drops of lemon juice on some common cooking soda and something will happen. We call it chemical action. The lemon juice contains acid, and the acids are a large and important class of chemicals Soda is one of the alkalies, another large class These two kinds of chemicals start chemical action easily and are therefore very important in manufacture The commonest of the acids is made of sulphur in the production of which the United States leads the world The commonest of the alkalies is soda, of which we also make a vast quantity, using chiefly salt and coke. The soda plants are thereby located over the salt deposits of New York and Michigan.

The laboratory and the factory. The chemist produces the painter's colors, the dyes of the weaver, the tannins of the tanner, the fertilizer for the farmer, the drugs and medicines for the physician, and raw materials for almost every factory Things that are experiments in the chemical laboratory are coming more and more to be done in factories on a large scale They are the basis of a rapidly growing industry so important in manufacturing that it is to be likened only to the use of power

I THE FERTILIZER INDUSTRY

The heaviest of all the chemical industries is that devoted to the production of chemical plant foods known as fertilizers. Of the several substances necessary to the growth of plants, three—namely, phosphorus, potassium and nitrogen—often exist in the soil in insufficient amounts or in unavailable forms, and must be supplied if prolific crops are desired (Fig 177). These three substances in many different forms and commodities are the main raw materials of the fertilizer manufacturer, and he ransacks the world to get them.

Phosphates. The bulkiest, cheapest, and possibly the most important of these plant foods are phosphates, which furnish phosphorus to the plants Much of the relatively minute amount of phosphorus of the world has been concentrated as phosphates in the bones of animals Consequently, it is from animal sources, directly or in fossil form, that nearly all available phosphorus is obtained Phosphorus is now chiefly obtained by man from the fossil remains of animal life, known as phosphate rock, from which, by the aid of sulphuric acid, fertilizer called acid phosphate, is made

No other country approaches the United States in phosphate rock resources. The mining of it started near Charleston, S. C, where the rock can be dug from pits For the past ten years Florida has mined about two million tons of phosphate annually—more than double the output of the rest of the United States, and two-fifths of the world output of this greatly desired product. New discoveries have been made in central Tennessee, and recently deposits of great extent have been found in the arid plains and mountains near the boundary of Wyoming and Idaho, not far from the Yellowstone National Park In addition to supplying the American market, we export about a million tons a year, chiefly to England, Spain, and Germany The port of Tampa alone sends about three-fourths of the export

Of late years the so-called basis process of purifying iron and steel has given us a new source of phosphorus. The limestone linings of the furnace draw the phosphorus from the molten iron and steel, and are later ground up and sold under the name of Thomas slag or basic slag, quite largely used as fertilizer in England and Germany It is used less in the United States because of our fossil phosphates

Potash. The second great raw material in the fertilizer industry is potash, of which we are heavy importers (440,000 tons, 1922) from Germany, which country has, under present conditions, almost a world monopoly, with over four-fifths of the world's production in 1922 Potash differs from phosphorus in that there are vast quantities of low-grade material as a possible future dependence. Mountains of rock (feldspar) in various parts of the world contain about 8 or 9 per cent of potash, but it is unavailable under the existing state of chemical

knowledge. So the whole world in normal times depends upon the mines of Stassfurt, near the Elbe River, in Germany, where, overlying a large deposit of common salt, is to be found the only important collection thus far known of available potash salts, of which there are several varieties. There is a smaller deposit on the upper Rhine, in French Alsace, and the vast salt beds that underlie an area from Salina, Kansas, to New Mexico have the possibility of duplicating the German deposits.

The scarcity of potash caused by the shutting off of German exports during the World War encouraged the hope that a potash industry might be established in the United States. Under the spur of necessity the production of crude potash rose from 4,000 tons in 1915 to 207,000 tons in 1918. Most of this was from natural brine lakes in Nebraska, California, and Utah, while a lesser amount came from kelp or seaweed, of which several hundred square miles exist off the Pacific Coast of the United States. Conservative estimates place the possible output of 100 square miles of this kelp at one million tons of chloride of potash, worth $35,000,000 per year, or more than double our present imports from Germany. This output permits the permanence of the beds because they feed upon the exhaustless resources of sea water. The manufacture of this potash was begun in California, but discontinued when German potash came back on the market. Most of the other potash concerns closed down, except some of the by-product manufacturers of cement mill dust. America has proved, however, that in time of need she can be independent of foreign sources for her potash, but at a higher price than that of easy German mining.

Nitrogen. The third, and most expensive, of the fertilizing materials is nitrogen, of which, despite the apparent scarcity, there are many and unlimited possibilities of output, because this rather inert element comprises three-fourths of the air, and we can draw upon it as we do upon water. Until recently we have had to draw upon the indirect sources of nitrogen. All animal matter is more or less nitrogenous, and fertilizer factories receive as raw materials the inedible animal products from the butcher shop, the slaughter house, and the fish cannery.

The greatest nitrogen-supplying raw material at present is nitrate of soda, which, like guano (and probably potash also)

accumulates in commercial quantities only in deserts, where the rainfall is insufficient to dissolve and carry it away. Some is produced in Death Valley, California, and the other deserts of California and Nevada, where it is found in small quantities as a white crust along with borax on or near the surface of the earth, and only needs to be hauled away and refined But the supply of the nitrate in commercial quantities is practically a monopoly of Chile, where the Nitrate Trust controls a supply that is variously estimated to be sufficient for a few decades or possibly a century. Fortunately this monopoly is not destined to pass into a world famine, but into an era of plenty through new inventions. Ammonia, one of the by-products of coke making, yields approximately as much nitrogen pound for pound as does nitrate of soda. The more economical use of our coal would enable the United States to make a half a million or a million tons of this product

While the coal may be exhausted some day, the air and waterfalls will not. The air is our final source The chemist and the electrical engineer have solved the problem of fixation of free nitrogen. Manufactured nitrogen is now a regular export from Norway, a product of the free air caught in the electric furnace by the electric spark from a hydro-electric current, generated in the defiles of the Norwegian mountains

These atmospheric supplies of nitrogen depend upon ample power for their extraction A very small population is required for the operation, and any distant source will do. For this purpose a 410,000 horse-power plant has been erected beside an Iceland waterfall and another is projected in a fiord on the coast of Labrador

Nitrate of calcium, called cyanamid, is made at Niagara Falls, but its production did not develop there until after it had been successful in Norway and France, where water-power is cheaper than in America One of the ideal sites for a nitrogen fixation plant using the cyanamid process, is at Muscle Shoals, Alabama, where there is a series of rapids in the Tennessee River, furnishing abundant hydro-electric power, and near to the other necessary raw materials—limestone and coal for coke. This project was begun by the government in 1918 in order to secure an adequate supply of war nitrates, and may ultimately supply cheap nitrates for the farmers' fields

The fertilizer industry and its location. It is plain why the fertilizer plant, drawing each of its staple raw materials from a different continent, finds the best location upon navigable arms of the sea, so that a ship-load of potash from Germany, bones from Buenos Aires, nitrate from Chile, fossil phosphate from Tampa, or sulphur from Galveston, can be unloaded direct from ship to factory. We thus find fertilizer plants established in or near almost every Atlantic port from Maine to Mexico Here fertilizer plants are also near their greatest market Since fertilizers are so largely used by the truck-crop growers throughout the Atlantic plain and on nearly all farms east of the Alleghenies, fertilizer manufacture is as yet essentially an eastern industry Georgia is the leading state in the manufacture, chiefly because it is an important cotton state, and the exhaustive one-crop plantation system of growing cotton makes the use of chemical fertilizers imperative

The future of fertilizer and fertility. We are just entering the era of artificial fertilization in the United States, because we have an increasing population, soils of decreasing fertility, and the new science of agriculture which is being disseminated with great rapidity (Fig 177) The comfort of our future depends upon commercial fertilizers almost as much and perhaps more than upon coal or iron Granted the ability to grow plants abundantly, science can probably adjust and meet man's wants, but without plants, nothing. Without any one of the three constituents, potash, phosphorus, or nitrogen, a field rich in every other requisite of plant growth lies barren. Even the careful Chinese have to abandon otherwise good land where they can get no fertilizer It is therefore fortunate that we have, even without the aid of the nitrogen-gathering bacteria upon plant roots, unlocked indefinite stores of nitrogen and potash With phosphorus it is otherwise. Speaking in terms of generations its supply is scanty and no ultimate reservoirs are yet in sight. Phosphorus is therefore probably the point of man's weakest hold upon the earth, and its waste in sewage, the loss of animal manures, and soil leaching, is a form of resource destruction with which the future must deal unless perchance we can open some avenue of phosphorus recapture from the great reservoirs of the sea

FIG 177 —Experiment showing the value of fertilizer at State College, Pa For 29 years these three plots have been planted in the following rotation corn, oats, wheat, and hay The plot at the left has received ground limestone, that at the right, nothing, that at the center, a "complete" fertilizer of dried blood, ground bone, and muriate of potash The yield of hay for left plot is 1,840 lbs. per acre, center plot, 4,640 lbs per acre, right plot, 1,320 lbs per acre

2. Soap-making and its Materials

Soap is produced by the action of soda or potash upon fats. This chemical reaction causes soap manufacture to be classed among the chemical industries In the United States the product amounted to $316,000,000 in 1919, or nearly 3 dollars per person, and in Europe it is also important Oils and fats used in soap making, like many other raw materials, seem to be of especial importance in countries of comparatively undeveloped industry Tallow, olive oil, cotton-seed oil, oil of sesame from India, groundnut or peanut oil, and cocoanut oil, are all the basis of large commerce. Many other fatty substances of animal and vegetable origin are also used, even including the grease that is removed from sheep wool in preparing it for the loom.

3 Coal-tar Dyes

A new source of colors. One of the chemical manufactures most typical in its scientific nature, its importance, and its relation to other industries, is that of dyestuffs For thousands of years man dyed his clothing with natural colors made from herbs, barks, and other vegetables and animal products The famous Tyrian purple of the ancient Mediterranean peoples was made from the pulverized shells of certain mollusks. Scarlet was later obtained by the use of cochineal, a dyestuff prepared from the dried bodies of insects native to Mexico and Central America. The rough homespun of the American backswoodsman was dyed a rich brown by the use of butternut hulls.

Artificial dyestuffs derived from that well-nigh infinite chemical mine, coal tar, are of relatively modern discovery. In 1856 an English chemist, while experimenting with aniline, a substance derived from coal tar, produced a brilliant violet dye Still other experiments resulted in the chemists developing a whole range of colors, which became known by the name aniline Over 700 distinct color dyestuffs have been developed and the total number of aniline dyes recognized by chemists is over 62,000 Chemistry has thus turned a former waste product from the by-product coke oven into a source of the rainbow hues used by man in coloring his clothing, food, and articles of daily use

Germany develops dyestuffs. As in many other fields of commercial chemistry, Germany was the successful pioneer in the coal tar dye industry because she had fostered science in her universities more than any other nation The first aniline colors were so inferior to the natural dyes that people became suspicious of anything named aniline, a prejudice which was hard to overcome By years of careful laboratory work the German scientists finally produced a range of artificial colors so excellent that they displaced the natural dye products, and so low in price that the rest of the world found it cheaper to buy from Germany than to develop a color industry Synthetic indigo was so successful that the export of natural indigo from India decreased from 21 million pounds in 1896 to a little over one million in 1922. Only the cheap labor of India makes any competition possible

Prior to 1914 Germany controlled the dye industry, with over three-fourths of the world production. In addition she furnished over one-half the primary or intermediate products used by other countries in their limited dye industries The total export of coal tar dye products from Germany in 1913 amounted to over $50,000,000.

Rise of the American dye industry. Soon after the beginning of the war a number of the largest textile manufacturing countries, including Great Britain, the United States, France, and Italy, found themselves cut off from their regular source of dye supply The development of colors at home became an urgent necessity The manufacture of coal tar chemicals had never been seriously attempted in the United States, and the first colors produced by the hastily organized industry were nearly as unsatisfactory as the crude dyes of the early aniline experimenters. However the manufacturers called in the best chemists, spent money freely on technical research, and finally were able to develop home dyes which compared favorably with the imported ones. Stimulated by the war demand chemical and dye plants were erected almost overnight and succeeded not only in supplying the home demand, but in capturing a large part of the former German export trade. In 1913 only seven dye plants, including one which was German-owned, were in operation in the United States No primary dye materials were

produced, the plants depending upon imported intermediates. In 1923 there were about 70 dye plants in active operation, manufacturing the crude as well as the finished colors, and producing 93.5 per cent of the dyes consumed in this country, whereas in 1914 we imported 90 per cent. The yearly output of the American dye industry is now valued at about $60,000,000, and our dye exports are more than double the imports.

4. Explosives

Explosives, long used for destruction only, have entered industry, and are performing rapidly increasing services. Without dynamite and gunpowder the prosecution of the mining and quarrying industries, and the building of our railways, tunnels, subways, and canals would be impossible. Our per capita consumption of explosives amounts to over five pounds per year. The danger and consequent cost of transport is the dominating factor which scatters the centers of manufacture as freight costs scatter cement plants. Among the raw materials for this industry nitrate of soda is important along with nitric and other acids, sulphur, and charcoal.

5. Products of the Electric Furnace

Another new and important group of chemical products is that produced by electricity or electro-chemistry. The great heat of the electric furnace is used in the manufacture of a number of crystalline substances, such as calcium carbide which is used for the generation of acetylene for lighting. It is manufactured at Sault Ste. Marie, Michigan, and at Niagara Falls, where the great power plants, run by the waterfalls, produce also all the carborundum made in America. These same crystals are produced in Norway and Sweden, where the moist Atlantic winds blowing against the high mountains give an abundance of rainfall and cause numerous swift streams that yield excellent water-power for the production of the cheap electric current, which seems to be the locating factor in this industry. Similar water-power advantages have developed the industry to large proportions in Switzerland which shares with Scandinavia the leadership in exports of this nature.

Questions

1 What is the relation of aridity to the supply of chemical raw materials?

2 Name a foreign trust from which invention is likely to emancipate us

3 Which is the better location for a fertilizer factory, Baltimore or Harrisburg?

4 What is the basis for the advice of conservationists that the export of phosphate should be prohibited?

5 How may a new source of inedible oil influence the price of edible oil?

6 Explain the influence of education on the chemical industry.

CHAPTER XV

THE MINERAL INDUSTRIES

The mineral industry has long shown an increasing importance for the baser materials. Coal and iron together make more than half of the total value of all minerals. The mineral industry of the entire world employs about six million persons, yet its output is not one-half as valuable as the product of the farms of the United States alone (Fig. 178).

I. Building Materials

The scarcity of wood and the resulting increase in price that came with the twentieth century are forcing the people of America,

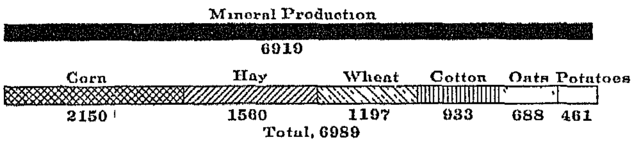


FIG. 178.—Mineral production of the United States compared with production of crops in millions of dollars.

like those of older countries, to find building materials in the earth's crust. After our nineteenth century saturnalia of tree slaughter and cheap wood, we are being driven more and more to adopt the building material used in Ancient Rome and used now in most parts of Europe, Asia, and north Africa. It is merely a sign of the declining ratio of land to man that necessarily accompanied the increase of population and the end of the frontier period.

The abundance of stone and clay permit quarrying and brick making to be widely distributed in response to local demand. The low value and great weight of these materials make them expensive to transport. In its wide distribution in response to scattered demand, the making of common brick resembles the

production of fresh milk. Of the total output of $63,000,000 in 1919, twenty states had each over $1,000,000 worth, and but four over $3,000,000. The regions of high output are the regions of large population—New York, Pennsylvania, Illinois, and Ohio. Thus, New York, the state with the greatest city population has also the greatest amount of brick manufacture. This industry is located chiefly in the Hudson Valley between New York and Cohoes where both railroad and river navigation furnish easy access to the enormous market of the cities about the mouth of the Hudson River.

The brick yard, with its smoking kilns and clay-mixing machines that shoot out the bricks by the mile and cut them off into lengths, is usually an industry with a very limited local market, although at Milwaukee and a few Ohio points special bricks are made for distant markets.

Although brick must be manufactured while stone is merely taken from the earth, the building stone is often more expensive to use because of the large amount of labor involved in quarrying and shaping, or in fitting rough stones together in the wall. There are several places in the United States where stones of peculiar merit or unusual accessibility give rise to large quarrying industries with a distant market. For this reason, New England has important quarrying industries along the sea coast where the scraping glaciers have exposed bare hills of slate, limestone, and granite. These quarries have access to the best possible transportation facilities, namely, that afforded by the sea-going vessels that can practically come to the side of the quarry in many sheltered bays upon the indented coast. Massachusetts is the second granite producer and Vermont is first. Quarrying is more important to this state than any other. Its granite for buildings and monuments is shipped to great distances as are those of New Hampshire, and its output of marble is nearly double that of either Tennessee or Georgia, its nearest rivals.

The marble industry of south Vermont near Rutland is one of the greatest in the world (Fig. 179). A splendid marble deposit is almost as accessible to the quarrymen as are the granites of Maine or New Hampshire. As in other extensive quarries, the rock is cut and lifted by mechanical methods and the product is sent surprising distances when one considers how many other

good unused marble deposits there are in the United States It is a clear case of the influence of an early start, an established

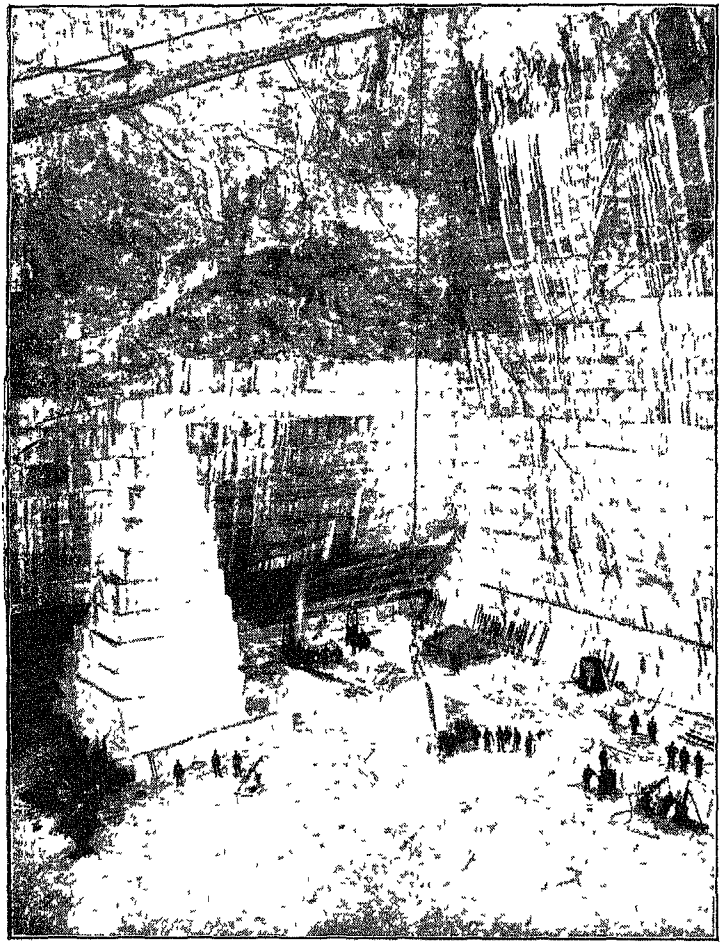


FIG 179 —Marble quarry, Proctor, Vermont. (Vermont Marble Co)

reputation, and good organization in continuing the success of an industry

The beautiful marble is far less important than the rougher, more rugged stone Its output is not as great in value as that of trap rock, the hardest of all, which is quarried in immense quantities and crushed for road surfaces Common limestones, used for road making, railroad ballast, and building stone are seven times as valuable as the marble output and furnish half the stone sold in the United States The limestone most used for building is the Indiana limestone (Bedford oolitic), from Bedford and Bloomington This stone is widely used in eastern states because of its durable character and the ease with which,

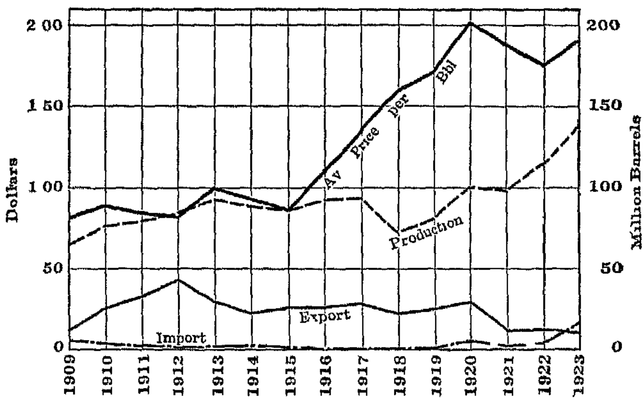


FIG 180 —Price, production, and import of cement in United States (After R Malcolm Kerr)

when first quarried, it can be sawed and worked into blocks and other desired building forms Upon exposure to the air it hardens, as do some Ohio sandstones. Although they send their products to great distances, these important quarry centers produce but a small amount of the total building stone, which is commonly dug from the quarry most nearly available to the place of consumption.

Cement. Cement is a mixture of lime and clay burned to drive off the water. Upon being wetted it absorbs water, hardens and becomes as durable as rock Cement is now largely used in making concrete, a mixture of cement, sand, and broken stone. It was the great building material of the Romans, whose experience

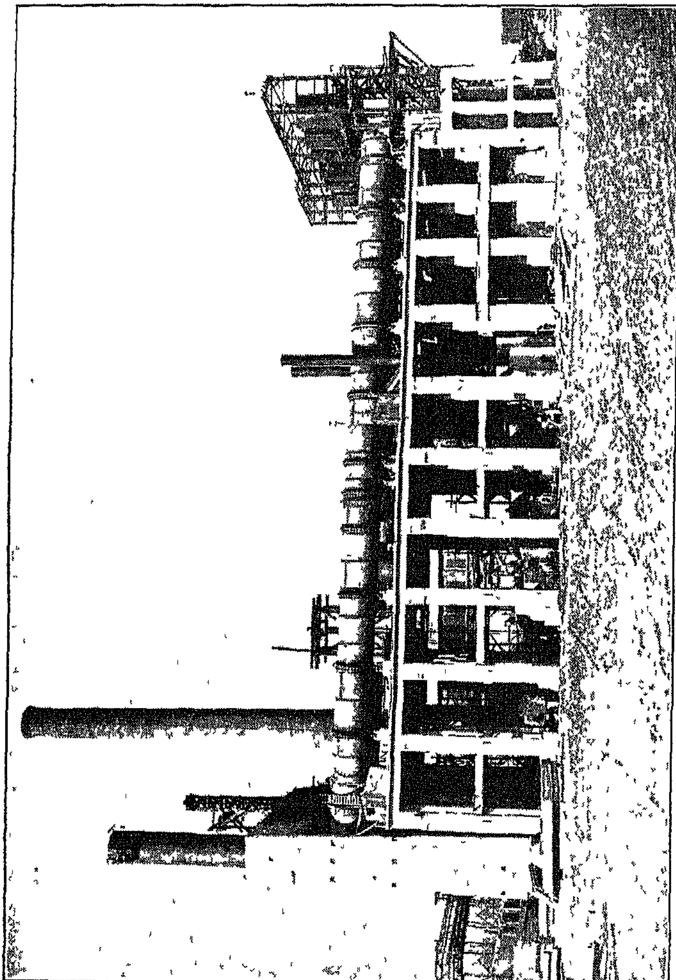


Fig 181 —Rotary cement kiln (Atlas Cement Co , Northampton, Pa)

has proved it to be good for 2,000 years Chunks of it lie to-day in wheat fields in Tunis and many other parts of the Roman world. Three new factors, the reinforcing of concrete, the rotary kiln, and high-priced wood and iron, have combined since 1890 to produce what is called the cement age in America. When reinforced by having a kind of skeleton of steel wires or steel rods within, cement construction becomes a substitute for stone, for iron, for steel, even for lumber, and can be used to build an entire house The

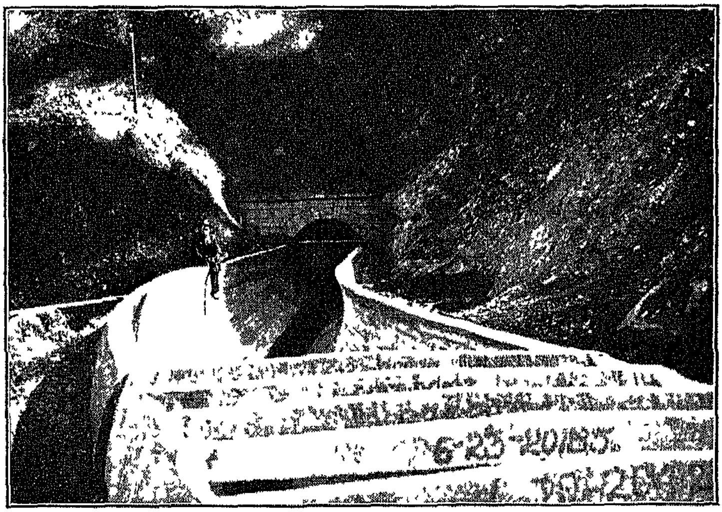


Fig 182 —In the management of water cement renders irreplaceable service Trail Creek, Yakima Irrigation Project (United States Reclamation Service)

resulting new uses brought increased consumption and the demand for cheaper processes of manufacture This brought the invention of the rotary kiln which has cheapened production (Fig 181) Cement has declined in price at the same time that its rivals, steel, iron, and lumber, have increased in price The resulting unprecedented increase in the industry has been one of the most sudden of all industrial changes. The United States is now producing more than a barrel of cement each year for every inhabitant (Fig. 180)

At the present time we are losing by fire nearly half as many buildings as we erect and the life of past constructions has at best been short. Good concrete buildings are permanent, and enrich the nation by their durability as well as by the saving in other materials. Cement has, in addition, exceptional ease of construction Mixed by steam power and poured into moulds, it is a natural product of machinery and unskilled labor. Standardized metal forms are now used repeatedly for all types of building construction Its use for girders, boats, fence posts, piles for driving into the ground, and shingles seems to indicate that there is almost no limit to the service cement can render (Fig. 182).

Materials and distribution of cement making. Fortunately the raw materials, limestone and clay, or limestone and shale, are to be found in every state and the fuel for burning is also widely scattered, so that there is the possibility of having many cement districts as the demand increases (Fig 183) The fact that the manufacture of cement uses about half its weight in coal has helped to make the Lehigh Valley in eastern Pennsylvania the leading cement section of the United States Here the limestone and shale are close together, at the surface, and only a few miles removed from the anthracite coal fields and near an abundant supply of good labor (from the adjacent Pennsylvania-German settlements). It is but 100 miles to the great markets and ports of New York and Philadelphia.

But the Lehigh Valley is making relatively less and less of the American supply because of competition of newer plants as in the Shenandoah Valley of Virginia, in Georgia, eastern Tennessee, Pittsburgh, New York, Ohio, Michigan, Illinois, Kansas, and elsewhere Like other earth-building materials, cement tends to be a local industry, and is now being made in over half the states of the Union The average factory price of a 380-pound barrel of cement in 1922 was $1 76 As shipping such a cheap and heavy product very far will more than double the cost to the consumer, it is plain that a local plant has a great advantage over distant plants

Cement from the iron furnace. The making of cement from blast-furnace slag, with or without addition of other substances, is a recent innovation, important alike to iron and cement makers. Since the disposition of this practically useless by-product of the blast furnaces has been a serious problem at many plants, the

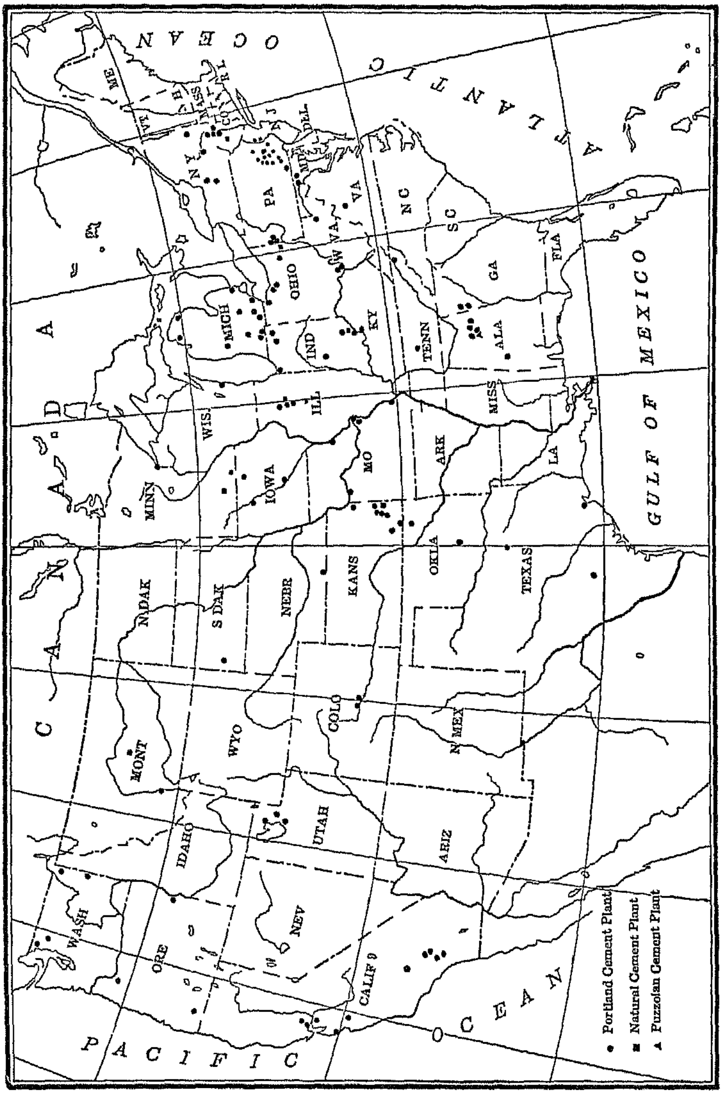


FIG 183 —The location of the cement plants in the United States shows that the industry tends to be a local one (After United States Geol Surv)

making of it into cement is a double advantage and is being extensively carried on at many American iron plants.

2. Pottery, Porcelain, and Glass

Utensils of earth materials are common among many primitive peoples and have been so for ages. They were left by the Mound Builders and made by the Indians before Columbus. The ancient Egyptians and Phœnicians were expert glass makers long before the beginning of the Christian era, and porcelain has been made in China for over a thousand years.

Glass is made by melting pure sand, which, by the aid of certain chemicals called flux, melts under high heat and remains transparent after hardening. Pottery, including its finer form, porcelain, is made by baking clay mixtures, which harden without melting. Pottery making in its simpler forms is a local industry which has survived the competition of the modern factory somewhat better than the textile industry has. The product is much more difficult to transport and clay suitable for some kind of pottery work is very common, although pure kaolin, the kind of clay used for the finest ware and which can be heated to 3,000 degrees without melting, is somewhat limited in its distribution. Large factories tend to concentrate the production of the better grades of product, but the cheapest grades tend to be made close to the market, as for example farm drain tile, made and used in the corn belt. Drain tile, short lengths of unglazed pipe, cheap, bulky, and difficult to transport because porous and weak, is mostly used as a sort of field sewer system, to carry off surplus water from the flat lands, especially in the North Central states, and make them fit for tillage soon after the rain.

Pottery and porcelain. The pottery and porcelain industries of the United States have increased very rapidly since the Civil War, but the best grades are yet imported from Germany, Czecho-Slovakia, and France. The two cities of Trenton, N. J., and East Liverpool, Ohio, manufacture much the greater part of the good pottery produced in the United States. Trenton alone has more than fifty potteries. The supply of raw materials for this city is diverse. The coal comes from the anthracite district of eastern Pennsylvania, and the local clay suffices for the coarser uses of the

industry. Quartz and feldspar are brought from the Adirondacks and the southern highlands of New York. Some of the clay comes from distant southern states, the best from Florida. Much of the finest clay is imported from England, being brought back very cheaply by vessels which take out cargoes of American agricultural products and must otherwise come back well-nigh empty. The freight rate from Cornwall to New York is a dollar a ton, and from New York to Trenton by rail is about the same as hauling a local clay four miles from the local pits. Trenton is one of the best places in the United States, if not the best, for a new pottery plant to secure adequate skilled labor and supplies—hence the concentration of the industry.

Ohio is the leading pottery state, with centers at East Liverpool, Zanesville, and Cincinnati. The coal mining state of West Virginia now ranks third, close after New Jersey. There are extensive deposits of good kaolin in North Carolina, Georgia, and other southern states. Small amounts are dug in Delaware and Maryland, but there is no prospect of the industry moving to these southern supplies of raw material, which can be so cheaply and easily transported to established centers of manufacture upon the edges of the coal fields.

Glass making. The quartz sand and flint for glass making are commonly melted at about 2,500° F. with an alkaline flux, usually soda, to hasten the melting. The chief raw material, quartz sand, is most widely distributed. It occurs in practically all countries, and near all our manufacturing centers.

The United States leads the world in the manufacture of glassware. Like iron manufacture, the industry began in Colonial times with a wood-burning epoch, which caused it to be centered in New England and the eastern states. Glassboro and Millville, N. J., and Philadelphia were until recently the leading glass-manufacturing towns in the United States. These eastern glass centers have abundant sand, but they are at some distance from their coal supply which they use in the form of producer gas. The gas-fed flames play around the pools of melted sand as it waits its final shaping at the hands of the glass blower or glass machine. Owing to the great fuel advantage possessed by the natural gas region of western Pennsylvania, West Virginia, Ohio, and Indiana, great gains have occurred in these states, which now manufacture

three-fourths of our glass The East has gained little in recent years Muncie and Gas City, Indiana, have had a great rise in glass making. The exhaustion of the natural-gas supply has centered attention upon bituminous coal as a fuel As a result the Pittsburgh district with both coal and natural gas is now the greatest glass-manufacturing district of the United States, and Pennsylvania makes a third of the product The Ohio Valley dominates this industry as it does the iron industry and for the same reason—fuel

WORLD'S MINERAL OUTPUT IN 1913

Commodity	*Metric Tons*	Percentage Contributed by					
		Europe	*North America*	*South America*	*Asia*	*Africa*	*Oceanica*
Bauxite	539,000	60	40				
Coal	1,342,300,000	54	40	(a)	4	1	1
Copper	695,310	13	65	7	8	2	5
Gold	685	1	27	3	11	45	13
Iron Ore	177,207,000	59	38	(a)	(a)	1	(a)
Lead	1,222,000	30	43	(a)	3	4	20
Manganese Ore	2,350,000	59	(a)	5	36	(a)	(a)
Nickel	29,000	3	86				11
Oil Shale	3,592,000	99					(a)
Petroleum	53,818,000	21	72	1	4	(a)	2
Phosphate	7,141,800	8	45		(a)	37	7
Potash	1,110,000	99			1	(a)	
Pyrites	6,000,000	90	8		2		(a)
Silver	7,000	7	76	6	3	(a)	8
Sulphur	1,000,000	42	51	1	6		
Tin	135,700	4		20	50	4	22
Zinc	1,027,000	38	37	(a)	4	4	16

(a) = less than one-half of 1 per cent

Glass resembles pottery in the abundance of its uses and it presents even greater difficulties of transport. The necessary heat and suitable fuel are much more difficult to secure than for pottery, so it is not so widely distributed and is not, like pottery, an industry of very primitive peoples. The United States imports some

European glass, especially the finest grades for lenses and for scientific work, but we also export to many countries the products of our inventive ability, in the form of our machine-made glassware. Machines have replaced hard labor and skill in most of the cheaper forms of glass.

3. Gold and Silver

On account of their remarkable malleability, durability, and beauty, these metals were highly prized for ornaments and coins

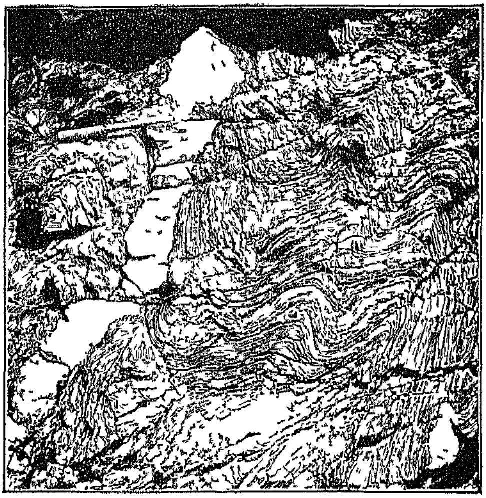


Fig. 185.—*A quartz vein (the white band) in metamorphic rock.* Muchals Caves, Kincardineshire, Scotland. (From Salisbury, Barrows, and Tower.) The uncertainties of mining are apparent.

even before the period of recorded history. The appeal gold makes to the imagination tends to cause an overestimate of its value. The world's output is of less value than the corn and oats raised in the single state of Iowa, yet, because of its use as the basis of all our commercial transactions, gold production becomes one of the most potent economic influences.

Widely scattered in the earth's crust, gold is collected into veins of quartz in many kinds of rock. The destruction of exposed veins

in the wearing down of mountains by streams has caused the transportation of gold along the courses of streams to great distances from the original veins. The miner's pan, not unlike a wash basin, suffices to extract the gold from the sand if there be water present in which to agitate the sand until the gold settles to the bottom so that the sand can be gradually separated from it. Large banks of sand and gravel, containing very small quantities of gold,

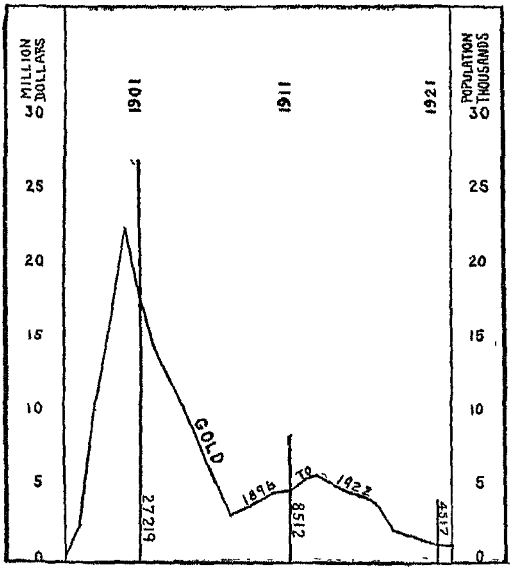


FIG 186—Gold production of the Canadian Klondike (Yukon Territory). Notice how the population has declined with the falling gold output

are worked by the placer process (Fig. 184), which consists of washing down the gravel banks by the force of a stream of water from a nozzle. The water carries the sand through long sluice boxes, with crevices in the bottom, in which the gold is caught, because, being the heaviest of the materials, it gradually settles to the bottom. This method has been used extensively in many parts of the world, especially in California, where streams have been so choked by débris as to fill up valuable channels in their lower courses and to cover rich agricultural lowlands with worthless beds of sand and gravel

The most permanent kind of gold mining consists in the working of the ores that are found in the veins themselves (Fig 185). The ore is usually ground fine by a stamp mill, and then washed by a process similar to that pursued in placer mining. This process does not, however, get out all the gold, and a newer method called the cyanide process dissolves the gold out of the pulverized ores

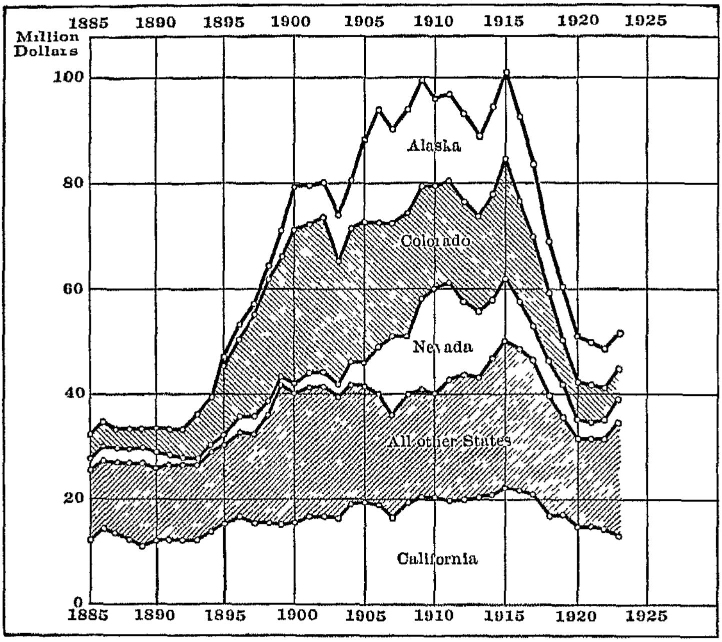


Fig 187 —The production of gold in the United States and in the principal states

by soaking them in tanks, and makes profitable the use of ores containing as little as $2.50 (less than one-eighth of an ounce of gold) per ton and sometimes even less than that This chemical process has greatly cheapened the extraction of gold from some ores and helps explain the fact that world gold production more than tripled in the twenty years from 1892 to 1912 (Fig 189).

The uncertainty of gold and silver production. Few industries have less permanence in any given locality (Fig. 186) than

gold, and it may be that the peak of production for all time has been reached

The quickly exhausted deposits of the Klondike were in sand and gravel along the streams where the individual worker could easily get the gold The increase after 1907 marked the beginning of the period of large-scale production at the hands of a powerful corporation which built 62 miles of flume and pipe line to operate placers, and a water-power plant with 36 miles of electric transmission line. With this equipment, the Klondike had a few more

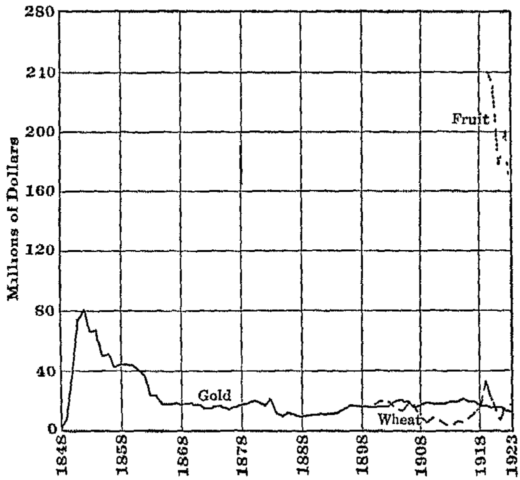


FIG 188—The gold production of California compared with the wheat crop and the fruit crop in value

years of prosperity and then another decline which will be final unless the mother lode is found The mother lode, if discovered, should last several decades before mining reaches its ultimate depth, which is now about 1 mile, and has been reached in the Victoria gold mines of Australia

The population of Nevada fell from 60,000 in 1860 to 40,000 in 1890 because of the exhaustion of one mine—the Comstock mine (chiefly silver) near Virginia City California, long the leading gold producer in the Union, shows the uncertainties of the industry by its frequent changes of base (Fig. 188) The gold

discovered there in 1848 was in stream beds. These were soon exhausted, and the miners next discovered many old abandoned river beds and even buried river beds which could be reached by tunneling under lava deposits. Then came placer deposits, and gravel worked by huge floating dredges. Finally the mother lode was discovered and the hard ore worked by deep shaft mining. California, which has been surpassed by Colorado with its vein

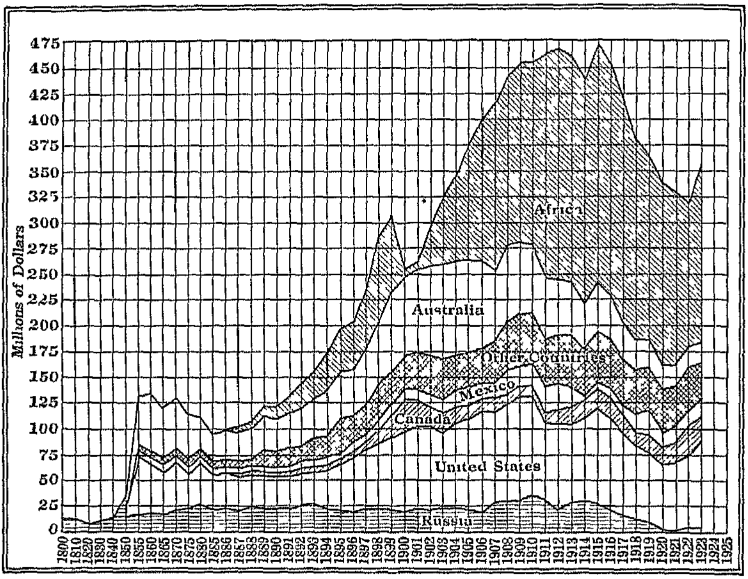


FIG. 189.—Gold production of the world and leading countries

mines, has been the leader from 1911 to date. Dredges produced half of California's gold in 1922.

Colorado cities, depending entirely upon mining, have arisen in almost inaccessible places in the Rocky Mountains, such as Leadville, nearly two miles above the sea, and Cripple Creek, which produces over half of Colorado's present gold output.

Gold in Alaska. Alaska, which in 1908 produced more gold than California, has three distinct fields. On the southeast are gold ores of low grade, worked in stamp mills, operated economically by fuel oil. In the Yukon Valley the centers at Klondike

(in Canadian territory) and Fairbanks, may eventually be succeeded by other discoveries. Cape Nome (beyond the Arctic Circle), on the west coast of Alaska, had a most unusual deposit, a sea beach so enriched by gold-bearing streams that a miner could pan $10 per day from the sands The day of the individual miner is passing, the gold beaches of Nome are now worked by dredges and the future of Alaskan mining lies in machinery and large-scale operation

Silver. In the United States, second to Mexico in output, silver mining depends for its prosperity upon the output of gold, copper, and lead, since silver is largely a joint-product of such

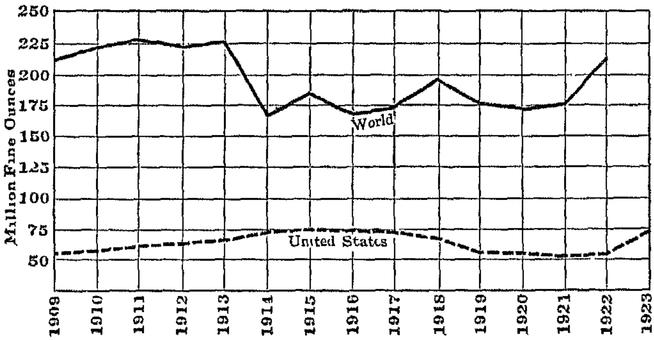


FIG 190 —Silver production is unusual in that its output does not increase as rapidly as that of most other metals This is due in part to financial legislation

mines The mines operated for silver alone are relatively few. The total output of silver in the United States, $75,000,000 in 1923 (Fig 190), barely equaled the corn crop of South Dakota, exceeded by 9 other corn-producing states

The future of gold and silver production. The World War caused a decline in the output of both these metals, due to the increased cost of mining and to interference with the industry Russia, which produced $28,000,000 of gold in 1914, fell to less than one million in 1921, and many mines of low-grade ore all over the world were closed down If the cost of labor and mining machinery declines sufficiently from its war peak many of the old mines will probably be reopened and new ones sought. Much of the world

has not been prospected adequately and further discoveries may be expected in Canada, Siberia, South Africa, and other little explored regions. Increase in production may even take place too rapidly for the welfare of the world, owing to the disturbing influence that large production is supposed to have upon prices, probably the most interesting aspect of gold production. Anyone can take gold to the mint and have it coined. Thus most of the gold becomes money. Money is used to buy goods. If money is plenty it becomes relatively cheap, so that a piece of land or a piece of meat commands more money than formerly and we say prices have risen. When prices rise faster than wages, people who depend on wages or investments are made poorer.

Questions

1. Explain the location of brick yards and porcelain plants.
2. Explain the past and present relative position of the Lehigh Valley in the cement production of the United States.
3. Is cement of equal value to agriculture in the East and in the West?
4. What factors locate a glass plant?
5. How may improvements in gold mining make it difficult for people to get along on a fixed income? How may shortage of gold affect the person with fixed income, the person with produce to sell?
6. How does placer mining interfere with the navigation of the lower courses of rivers?

CHAPTER XVI

THE TRADE AND ROUTES OF NORTH AMERICA

The internal trade of the United States is vast, the country is almost a world in itself, so great is the variety of natural resource. Not since the founding of the Republic has there been any tariff to interfere with the full development of regional specialties. This great, unmeasured domestic trade is favored by nature The surface and contour of the North American continent offer easier paths for commercial routes than those of any other continent except Europe. Most of the habitable areas are comparatively near to, or are easily reached from, healthful coasts and suitable harbors.

The center of gravity in North American industry, population, and commerce is, and will long continue to be, in the southeastern temperate region, the region comprising the Atlantic Slope, the basin of the Great Lakes and the Mississippi Valley east of the meridian of 100° W (Fig 191). This section is especially favored for transportation within itself and for access to the sea The slightly sunken coast line affords numerous good harbors, with value increased by a moderate tide Inland waterways are afforded by the Great Lakes, the Mississippi, the St Lawrence, and the rivers and bays of the Atlantic Coast (Fig. 192). There are few mountain obstructions, and in the interior the Mississippi Valley is almost level, opens broadly to the Gulf and further has the phenomenal advantage of almost level passages to the Lake Basin, to the Atlantic Slope and to the areas draining into the Hudson Bay and the Arctic Ocean. The problem of getting out to the Pacific, although of considerable difficulty, is easier than crossing the Alps or the chief mountains of Asia or South America Excellent climate and abundant natural resources in the temperate sections complete the conditions necessary for the development of trade routes unrivaled in the size of their commerce

We have strangely failed to utilize all our advantages, especially

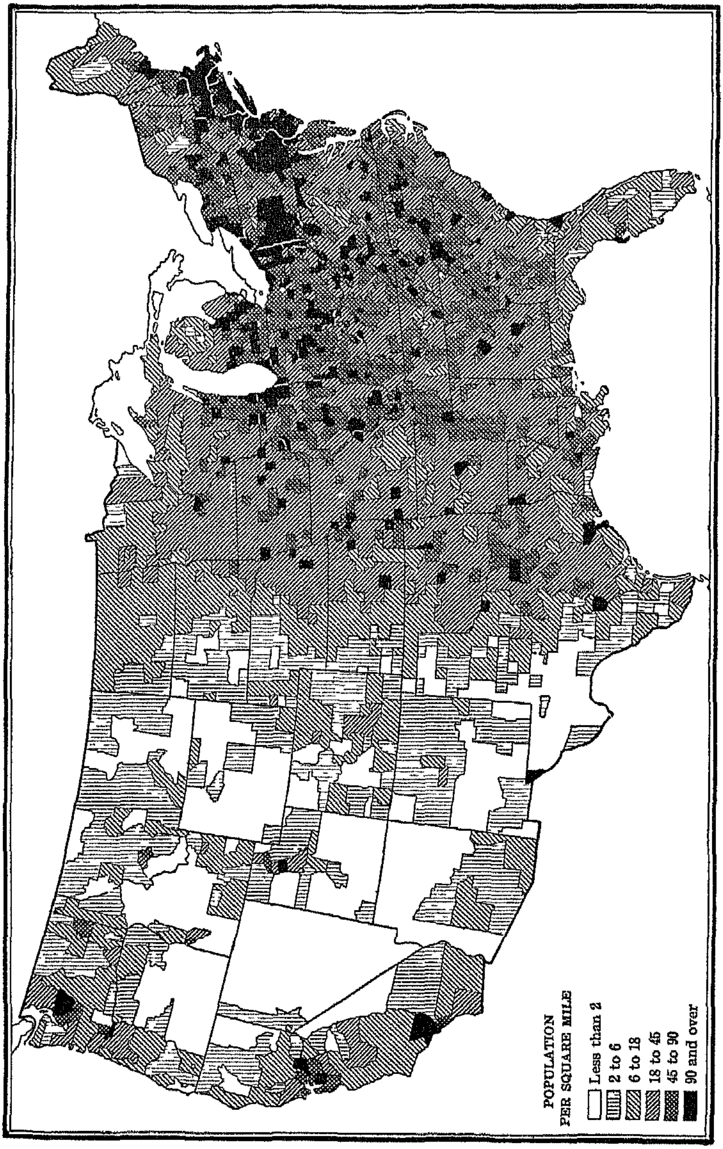


FIG. 191.—Population per square mile, by counties, 1920. (Bureau of the Census)

our waterways, which are ahead of those of any other nation in extent, distribution, navigability, and ease of use These little-used resources consist of 25,000 miles of river now used to some extent, 25,000 miles that might be improved, 2,500 miles of largely abandoned canals and 2,500 miles of bays and sounds that need connecting by canals The rivers and canals have languished and the railroads have thriven because we have been an individualistic rather than a social people The individual or corporation could make a fortune from a railroad, while the river, free to all,

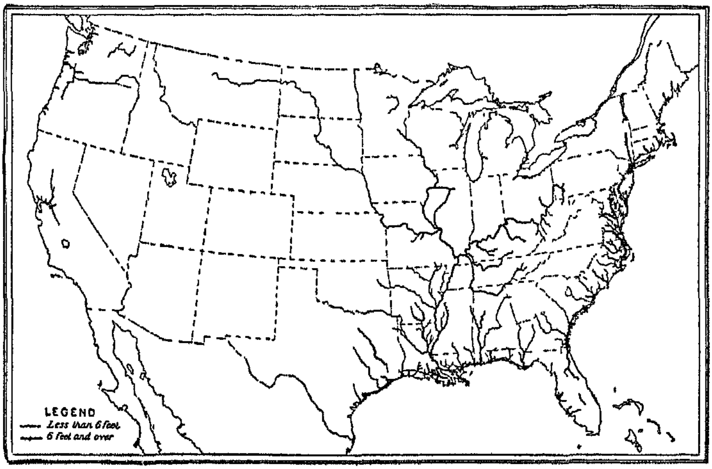


FIG 192 —Navigable rivers of the United States

merely interfered with the monopoly of the railroad interests and favored the shipper rather than the carrier Before the coming of railroads, this country, like many others, was dependent upon rivers to an extent now little known Thus the Ohio and Mississippi Rivers were the first great avenues of trade, travel, and settlement in the country west of the Alleghenies, which they commercially dominated till 1850. But these streams were not adequately improved and the Great Lakes were; hence they dominated the commerce of the last half of the nineteenth century as the Mississippi dominated the first quarter.

Influence of the Great Lakes in making routes. The primary routes of the continent are those connecting the continental in-

terior—the upper Mississippi Valley and the Great Lake Basin—with the Atlantic On the south navigation from the distant Gulf of Mexico was all shut off until the steamer came (1812) and on the north it is still shut off by the Niagara Falls and the rapids of the St Lawrence save for boats carrying about one-fifth as much as the Lake boats. The Ohio Valley frontiersman, in the day before the steamboat, took his flatboat load of produce to New Orleans, sold it, sold the boat because it could not be got upstream, and walked home with his silver dollars His few import goods he bought from another flatboat that came down from Pittsburgh, the end of a long wagon journey from the Atlantic The Mohawk River, flowing out through the only complete break to be found in the Appalachians between Maine and Alabama, gave the key to the Lake commerce The completion of wagon roads across the state of New York about the beginning of the century was followed by the opening of the Erie Canal in 1825, the first extensive canal in the United States. The tapping of the Lakes by this canal was revolutionary for the commerce of the West. A barrel of flour, which before this had consumed its profit in paying wagon freight for a hundred miles, could now be taken from the Lakes to the sea for a tiny fraction of the former prohibitive freight A large territory in the heart of the continent was given commercial possibilities, because the new route made possible a commerce with Europe by way of New York Lake shore points throve, having access to the sea through the canal They also became the bases for the starting of railroad lines into the corn belt states a few years after the Erie Canal had virtually made the Lakes into a commercial arm of the sea The building of railroads to the West was most easily accomplished along the open route followed by the Erie Canal. This was a profitable place, too, for the building of a railroad, because here were already in existence the traffic-breeding centers of population that had grown up in the territory enriched by the canal that had made cities in the wilderness

The Great Lakes thus have dominated the development of trade routes in the railway era Along their shores are the greatest interior populations and trade The lake freight rates, which have been and are but a fraction of land rates, were a freight attraction that gave any lake port commercial command of the

territory behind it The Lake shores have, therefore, always been magnets to the railway builders Whenever possible these men have brought their lines to the Lakes at some point or points so that they might forward to the eastward by boat and get a share of the water-borne Lake traffic, going west Consequently the Great Lakes have been the deciding factor in locating one terminus of most of the railroads of the central west (Fig 194) The trade routes of this region may now be likened to a section of a thick cable woven of many strands which are untwisted and spread out fan-like at each end The Lakes, with their steamship lines and the competing and auxiliary railways that follow their shores, make the central or compact sections of the cable The loose ends are represented by the many lines of railway that

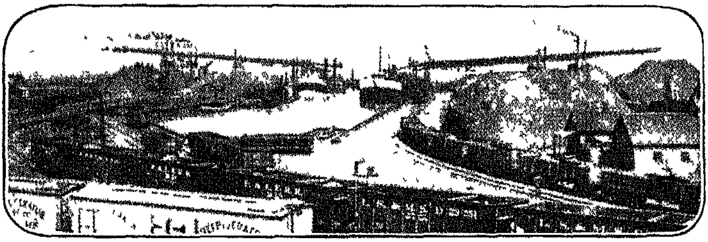


FIG 193 —Iron-ore dock, steamer, railroad terminal, ore unloaders and ore storage at a Lake Erie port

converge at the western Lake ports, and by the other lines that diverge from the eastern Lake ports to the Atlantic Coast

Once the railways have brought their grain, lumber, and ore to the Lake ports, water transportation renders a great service From Duluth, Port Arthur, and Fort William on Lake Superior, from Milwaukee and Chicago on Lake Michigan, and from Toledo on the Maumee near Lake Erie a vast fleet of steamers and barges busily and cheaply carry freight to and from Cleveland, Buffalo, and even Montreal on the east. But the railroads because of their greater speed are also busy with the east and west traffic North of the Lakes, between the Lakes, and with many lines south of the Lakes they keep up a constant competition with the Lake vessels, and, in the winter months when the Lakes are frozen, they must carry all the freight The railroads also get at all seasons the

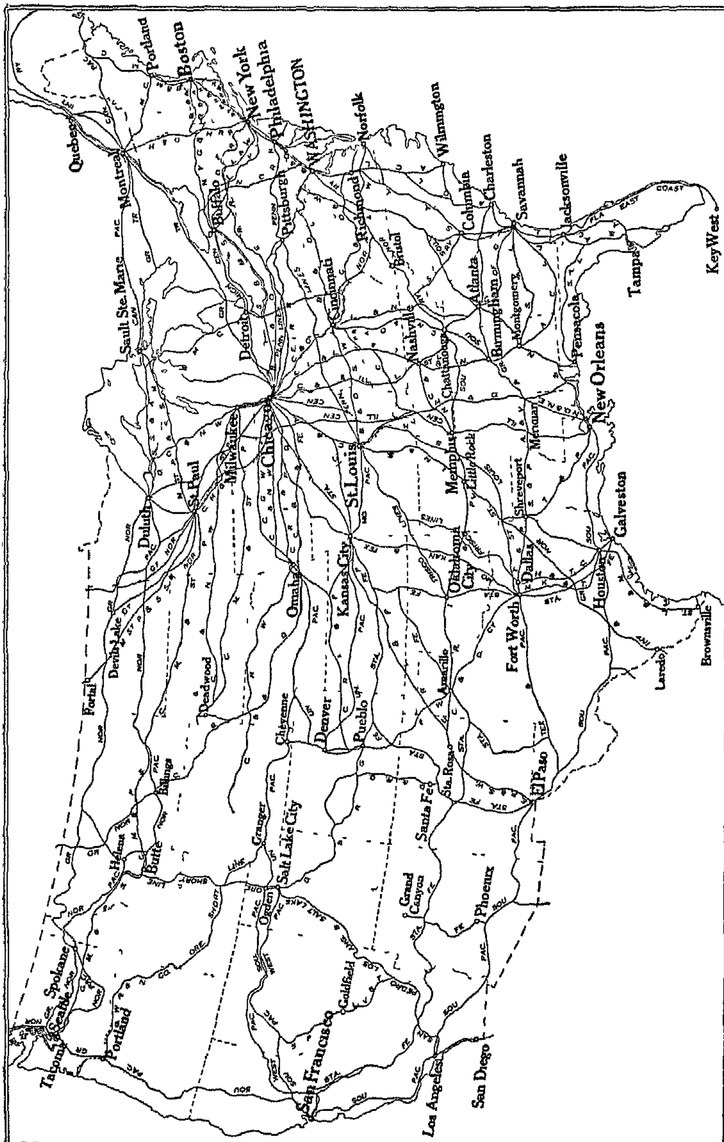


FIG 194.—Map showing leading trunk railroad lines in the United States

vast amount of high-class freight for which there is need of haste Thus, meat, one of the greatest if not the greatest single product in value in the whole Lake basin, goes eastward chiefly by rail from the great packing centers of Chicago, Kansas City, Omaha, and Sioux City. The eastbound grain from these same markets gravitates toward the Lake steamer, since speed and temperature are not so important in its transit

The traffic of the Lake region. In numbers of tons per year the traffic through the American and Canadian canals around the rapids at Sault Ste Marie at the eastern end of Lake Superior far outranks that passing through the Suez Canal (Fig 195). The tonnage of freight passing Detroit is as great as the combined foreign trade of New York, London, and Liverpool, although it is of far less value per ton The enormous shipments of iron ore are the largest single item. Shipments of lumber, coal, and grain also assume great proportions In 1923 it was estimated that 69 million vessel tons passed through Detroit River carrying 92 million tons of freight worth one billion dollars.

The Welland Canal at the other end of the Lake, with about one twentieth as much freight, shows the limiting influence of shallow draught, 14 feet as compared to 21 in the channel at the Lime Kiln Crossing below Detroit.

Before the world war millions of tons of coal were carried from the southern shores of Lake Erie to the upper lakes at a freight rate of 30 cents per ton The ore rate was commonly 65 cents from Duluth to Ashtabula, near Cleveland, and grain was carried nearly 900 miles from Chicago to Buffalo for 41 cents per ton The lower rate westward was due to the competition of the many vessels for the relatively small return freight. In the season of 1924 the wheat rate from Chicago to Buffalo varied from one and one-half cents to five cents per bushel of 60 lbs —a competent rate. In 1923, 78 per cent of the traffic through the Sault Ste. Marie Canal was eastbound. Important articles in this total of 91.3 million tons were iron ore 59 2 million tons, wheat 283 million bushels, other grain 87 million bushels, flour 10.4 million barrels, copper 60,000 tons, westbound, 16 7 million tons bituminous coal and 1 7 million anthracite.

The Lake steamers are a highly specialized type. They are just as deep as the builders dare make them to pass through the 21-foot

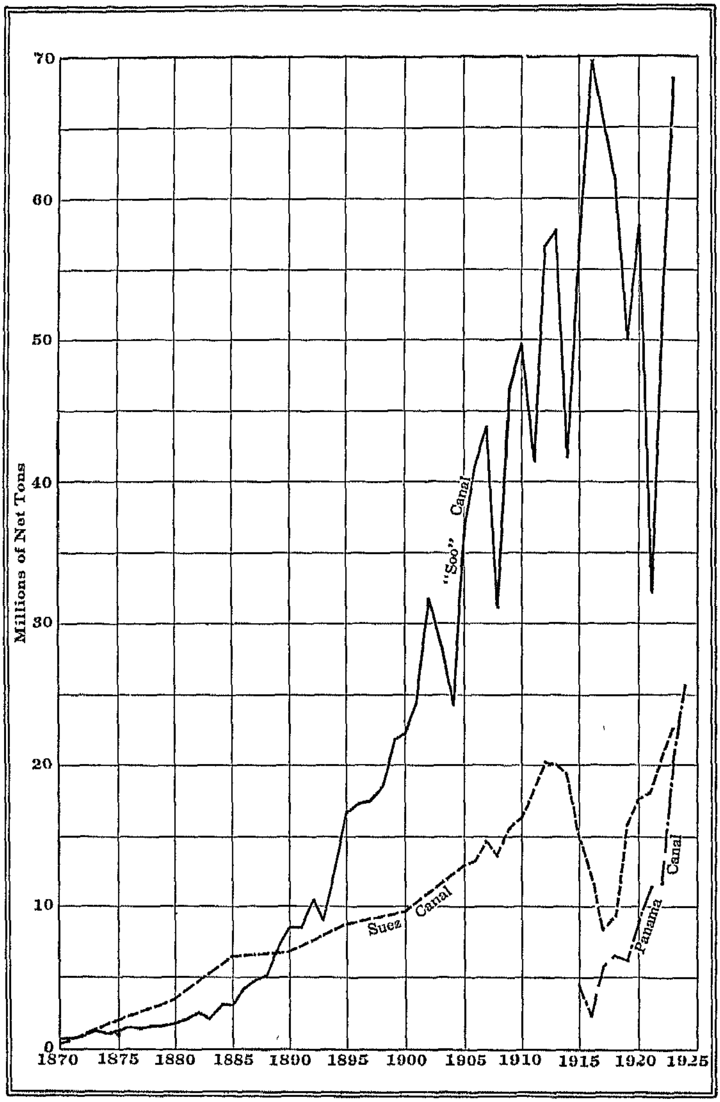


FIG 195 —Canal tonnage at Suez, the "Soo" and Panama.

channels that have been dredged in the shoals between lakes They are built with many hatches for fast loading, in which gravity is the chief factor (Fig 196) In unloading the bulk cargoes, especially of ore or coal, clam-shell grab buckets, some of them of 15 tons capacity, reach into the bottom of the ship and grasp minerals as human hands would scoop up sugar (Fig 197, Fig 193) Ten thousand tons of ore have been loaded in 39 minutes, and 10,000

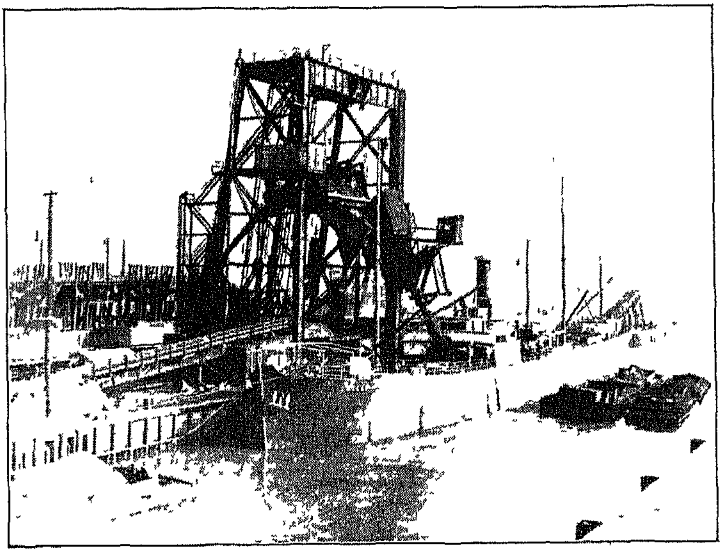


FIG 196—The car load of coal is being dumped as easily as a bowl of sugar (Pennsylvania Railroad Co , Philadelphia)

tons of coal unloaded at Duluth in 15 hours These factors of economy explain why the Lakes draw the traffic, and why the Lake cities have grown.

Chicago is at the tip of the Lake that reaches farthest into the corn belt. All routes from the East to a large northwestern area were compelled, in rounding Lake Michigan, to pass this point, which naturally became the greatest railway center in the world (Fig 194) Cleveland, Toledo, and Milwaukee had less commanding positions and grew less rapidly. Duluth, at the head of

Lake Superior, is the gateway to a territory that, although much later in its development than that around Chicago and much less favored by climate, causes a large and increasing volume of freight, both outgoing and incoming. Port Arthur and Fort William, Canadian cities on the western shore of Lake Superior, are sister

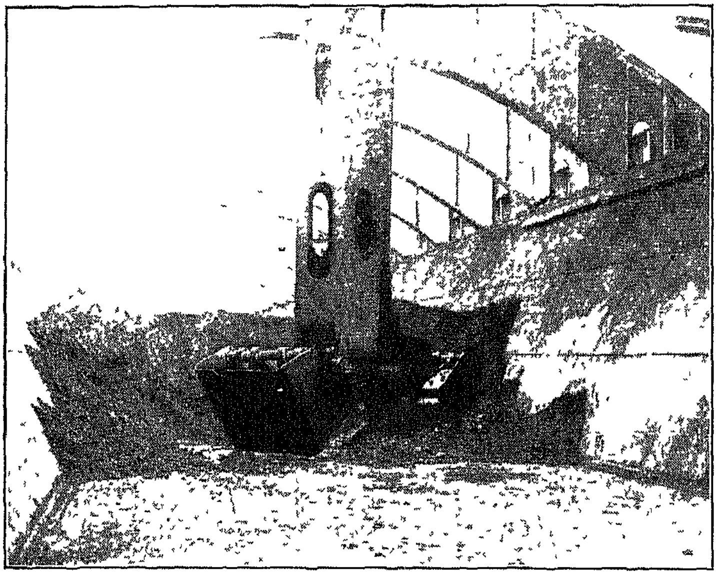


FIG. 197.—Grab buckets of Hewlett automatic ore unloader lifting cargo from the hold of one of the Great Lake boats with its continuously open decks. (Wellman Seaver Morgan Co., Cleveland.)

cities and also rivals to Duluth, sharing with her the forwarding trade to and from the spring wheat country to the westward.

West of the Lakes the railroads can and do spread out in all directions where there is traffic (see Fig. 194). At the east end of the Lakes Buffalo holds a position as traffic distributor, corresponding to that of Chicago and Duluth as traffic assemblers. Trunk-line railroads connect it with Boston, New York, Philadelphia, and Baltimore, and the state of New York has spent over 100 million dollars in rebuilding the Erie Canal so that it can carry 1,000-ton barges and enable the port of New York to continue as the metrop-

olis of Lake traffic. The service of the Erie Canal is not to be measured in tons actually carried any more than we measure the value of a policeman by the number of arrests he makes Every spring for many years the grain rates on the railroads went down when the canal opened because the canal gave free competition on a cheap highway Whenever the canal reduced the rate the railroads had to meet it. Thus the canal has reduced the rate on nearly all the hundreds of millions of tons of freight that have passed from the Lakes to the sea in the last hundred years—a service of incalculable value This fact explains the bitter fights that the railroads have so often made to kill the canals (Fig. 198).

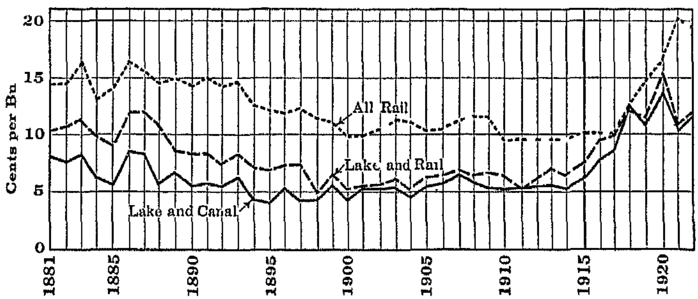


FIG 198 —Water transportation is a controller of railway freight rates

It is interesting to speculate on the probable results of the success of the rival plan to improve the St Lawrence and the Welland Canal, making that route even cheaper than the New York Canal

To the south of the Buffalo routes three other trunk routes of importance connect the Lake shore and the Ohio Valley with the Atlantic ports between Norfolk and New York

This rather surprising number of routes to and from the Great Lakes is due to the remarkable topography of the basin of this group of lakes They lie at the very top of the continental mid-region, *upon its very roof*, a reservoir and water transport system on a level plateau By the digging of a mere canal at Chicago the waters are diverted to the Mississippi The four southern lakes are so nearly on a level with the general surface of the country, that they can be approached by railway at almost any point suitable or

desirable for the landing of vessels. Hence, the multiplicity of routes to them and from them

The traffic on these east and west routes from the Atlantic Coast states to the western plains is the heaviest railroad traffic in the world, and comprises in the main the eastward movement of raw materials and food—grain, flour, lumber, ore, copper, meat, and cattle foods in exchange for the westward moving manufactured articles and imports in almost infinite variety The heaviest single item going west is coal, chiefly the superior grades from Pennsylvania and West Virginia.

Between the Chesapeake Bay and the Gulf there are no railroads of the first magnitude going inland from the Atlantic because there is no inducement to take export goods across the mountains to this corner of the continent The region of the lower Ohio has sufficient natural outlets toward the Gulf or the Atlantic north of the Carolinas Charleston, Savannah, and the lesser south Atlantic ports are fed by the local railways and the navigable rivers in the Atlantic plain. This limitation of hinterland gives them a prospect of permanently small size in comparison to that attained by ports having easier connection with the center of the country

The side doors of the continent. This great sheaf of east and west routes bound together by the Great Lakes, and reaching into the center of the continent, has really included more territory than it can hold As the result of transitory rather than permanent conditions of settlement, it has, in grasping for the vitals of the continent, overreached and placed itself in unstable equilibrium by taking trade that can, with the improvement of routes, go more easily by the side doors to the south and to the north—the Gulf of Mexico and possibly Hudson Bay.

The Mississippi River with its boats or the possibility of boats has rendered in its field a rate control service almost identical with that of the Erie Canal. The Mississippi Valley with its natural outlet toward the Gulf has created, first, New Orleans on the great river near its mouth, then at the sides of the valley, Galveston, Mobile, and Pensacola, which have become important with the building of the railways from the productive districts to the northward. These are all cities of the second class, but they are all at the ends of promising lines of trade to the upper valley. Each also has a rich local territory in the cotton belt. Mobile has in addition, Alabama iron

and coal, and the navigable Warrior River which permits barges from Mobile to come within a few miles of the coal mines Galveston can command Texas, Oklahoma, and Kansas grain Although the routes to the Gulf ports at present are drawing but little freight from beyond the Ohio and Missouri Rivers, their trade is growing and in the course of the coming decades these routes will be extended to the North, and perform a more important part in our foreign trade particularly with South American and Oriental ports. As the population and industries of the United States grow more like those of Europe, the commerce of the Central States will be relatively less with Europe and the East and more with the tropics The opening of the Panama Canal is another strong factor helping to change the commercial front of the Mississippi Valley from the Atlantic to the Gulf The lower Mississippi Valley, with vast undeveloped resources, also has great industrial changes before it, so that it is possible that by 1950 the Gulf routes may equal in commercial importance those that connect the Great Lakes and the Ohio with the north Atlantic. These predictions are by no means dependent upon pure speculation These changes are already in evidence and are progressing rapidly Nature is with them

This does not mean that we shall see any decline for the eastern roads. Under present normal conditions they are and must be congested, crowded, overburdened with a traffic that results from the great growth of commerce which has come to stay New trade will go to the Gulf For example, the wheat trade of Kansas City is already greater than that of Chicago, and Kansas City is distinctly in Gulf rather than Atlantic territory The distance from Kansas City to Chicago is 458 miles and the wheat rate 17½ cents per hundred, to New York, 908 miles farther, it is 40 cents if for export, from Kansas City to New Orleans, 880 miles, and to Galveston 851 miles, and the rate to both is 30 5 cents for export wheat and 41 cents if for domestic consumption. Thus the American railroads favor export traffic

The trans-continental lines. Between the Pacific Coast and the more populous East lie the Great Basin, the Rocky Mountain plateau, and the Great Plains, now crossed from east to west by eight railways. They are commonly known as the

"Trans-continental Lines," but with one exception they lose their identity at the middle of the Mississippi Valley, which may really be considered their eastern end. They here serve as feeders to the Lakes and eastern routes described above, which forward the freight from any and all of them to the Atlantic coast points. In the competition for the trans-continental trade, the northern and southern routes are more favorably located than the central, and the most southerly route, the Southern Pacific, has, in some respects, the best location of all, and in other respects the worst. This route, having its termini at San Francisco and Los Angeles in the West, and at Galveston and New Orleans in the East, has the shortest land carriage, but it has the disadvantage of crossing the most arid part of the United States. Travelers commonly call it desert. From Galveston and New Orleans the route is in reality continued to New York by regular lines of steamers operated by the same company. This combination of railways and steamship routes secured much California trade with the East before the opening of the Panama Canal. The northern routes, Canadian National, Canadian Pacific, Great Northern, and Northern Pacific, with their termini on Lake Superior, utilize the cheap water transportation of the Lakes, operate steamers to Buffalo, and have regular traffic arrangements with the railways from that point eastward. The Canadian Pacific also has steamers from Atlantic tidewater to Europe. The northern routes are also shorter than the lines that cross the central or widest parts of the United States as may be seen by reference to a globe.

The development of transportation facilities in the region has been most rapid. In 1849 caravans of gold seekers' wagons crossed it en route to California. The first regular transportation service across the Great Plains was the "Pony Express," relays of galloping horsemen carrying small packets of letters and valuables. This was succeeded by wagon trains that set out from St. Louis, Kansas City, and Omaha for New Mexico, Utah, and California. In 1869 the first railroad (from Omaha to San Francisco) was built through the aid of the United States Government at a time when the buffalo and Indian still held possession of the Plains. The present number and striking appearance of the trans-continental railways, when shown upon

a map (see Fig 194) tend to give an exaggerated impression of the part that they play as through carriers of freight. The strictly trans-continental traffic, aside from passengers, mail, and perishable fruit and vegetables, is not large This is due to the prohibitively high cost Thus the wheat rate is 35 cents per 100 pounds from Logan, Montana (111° W), the traffic divide on the Northern Pacific, to the Pacific or to Duluth (1,055 miles) Either terminus of this road is thousands of miles from the price-setting market at London. The chief service of these routes is as carriers of the freight produced along the lines, or of coast traffic consigned to interior points.

There is, however, a large traffic of an essentially trans-continental character Thousands of carloads of oranges, peaches, apples, and grapes with some dried fruit are annually carried from points west of the coast range to points east of Chicago and even to the Atlantic Coast cities. Manufactures of great value are taken from the manufacturing east to the essentially non-manufacturing Pacific Coast There is also considerable overland shipment of oriental teas, mattings, and silk, but the heaviest traffic across the Rockies is in lumber, chiefly from the state of Washington This traffic is increasing rapidly, for Washington lumber is becoming common not only in the Mississippi Valley, but also east of the Alleghenies The efforts of the railroad managers to get return freight for their lumber trains have caused the shipments of a large amount of exports to the Orient via Pacific ports. In this way cotton has been exported from Texas to Japan via Seattle, when its more natural route was by way of the Panama Canal.

The people of the mid-region of the trans-continental railroads are great traffic producers They are almost exclusively engaged in agriculture, mining, or lumbering. They are far from their markets and their sources of supplies. They sell much and they buy much, so that a single farmer's family in the region of the Great Plains is reckoned by some railroads as contributing $500 a year income to the company This explains their diligent labors to get settlers on their lines.

The routes of the Pacific Coast region. The trade routes of the Pacific states are simple The centers of population are near the coast. Aside from the southern coast settlements, and

the northern lumber towns, California consists essentially of a long valley extending to the north and south, opening at San Francisco Bay and drained by the Sacramento and San Joaquin Rivers. A railway net spreads over these valleys and the lines follow the rivers to the sea at San Francisco. In the south the coast range is low and it has not been difficult to build railroads which pass out of the San Joaquin Valley and reach the sea at Los Angeles, the port and center of a populous and prosperous district, and also at San Diego. The ocean trade of Los Angeles grew like a mushroom between 1910 and 1920. In the northwest the chief productive regions (aside from lumbering) are the Columbia and Willamette Valleys, which also furnish routes for railways to the port of Portland. The Columbia is also navigable to the eastern boundary of the state of Washington, but the great excellence of Puget Sound for the development of great harbors and ports, combined with the richness of its immediately adjacent territory, and the shorter route to a rich interior, marks it as the site of the coming commercial and industrial metropolis of the Pacific Coast of all America. In 1922 the vessels engaged in foreign trade, and entering Puget Sound ports, had a tonnage of over four million, while those entering San Francisco amounted to one and one-half million tons.

The nearness of the Pacific Coast population to the Pacific causes the Panama Canal to be easily effective in stimulating their trade, which with its raw products, is so dependent upon the markets of populous regions.

Alaska. In Alaska the arctic interior of the continent has been invaded by modernized trade routes, and the dog sledge and the human pack carrier have been succeeded on the main line of trade by the railway and the steamboat. The Klondike gold fields, lying upon the upper Yukon on both sides of the Alaskan-Canadian boundary, were at first reached by the trail over the mountains near the coast of South Alaska where a short but fearful journey separated sea and river navigation. Within two years after the important gold discovery on the Klondike (1897), the railway, beginning at the harbor of Skagway, had crossed the mountain pass and connected the steamer on the fiord coast of south Alaska with the brave stern-wheeler that risks the shifting sands of the Yukon. But this river is

open only in the summer months and must be *entered* from St Michaels, across a part of the Bering Sea The lower river route to the Klondike is hundreds of miles longer than the more direct one over the mountain ranges that separate the upper Yukon from the Pacific The Alaska Railroad, built and operated by the United States Government, now connects Seward with Fairbanks, nearly 500 miles north on the central Yukon.

The possibilities of travel in the interior of Alaska are being greatly improved by the domesticated reineeer, which has been introduced by the aid of the Government. This draught animal is perfectly adjusted to North Alaskan environment where it can also furnish meat and milk It will be a great aid to prospectors and miners in the search for minerals in which Alaska and northern Canada seem to be promising.

Seattle and San Francisco are the chief trade bases for the vessels, mostly the steamers of two companies which carry almost the entire trade of Alaska. Alaska sends gold and copper, fish (mostly salmon) and furs in exchange for the great list of foods, clothing, and supplies, needed by white men in a cold land, not well suited to agriculture

Waterway improvements in the United States. The United States needs more facilities for transport, as shown by the freight congestions that clog our railroads in times of prosperity There is much talk in the United States in favor of the improvement of our waterways At present they are in an astonishing stage of neglect Some experts say that they really cannot compete with railroads Others point out their neglect is due largely to the deliberate refusal of the railroads to cooperate with the waterway We must remember that the first object of a railroad company is to make dividends If after that it can serve the country, well and good, but none of us will invest in a railroad unless it can make profits This makes it clear that our waterways have not had a fair test as to their possible services as an integral part of an organized, national transport service. The creation of such a service has been nobody's business save for a short time during the World War, when the use of waterways made interesting innovations The Mississippi River is one of the finest natural waterways possessed by any people It is 1,156 miles from New Orleans to St Louis and thence 697

miles to Minneapolis and 406 to Kansas City. There is no steamboat line running the whole length of the stream, and except for coal barges and rafts it is very largely neglected at a time when we need new facilities and it is known that railway transportation is several times as costly as water transport. St. Louis, served by twenty-four railroads, and receiving three million loaded cars per year, and Kansas City, served by thirty-nine railroads, are connected by 406 miles of navigable river which for years was entirely unused. Then it was used for a few years by the United States Railroad Administration, which was trying to make a national transport system.

The waterways can only become effective when effort is made to have through routing of freight and this the railroad companies have usually refused to do as a part of their diligent (and from the dividend standpoint, wise) policy of thwarting the development of water transportation. Another necessity of success with waterways is the necessity of uniform and far-reaching system in the construction of locks and the maintenance of depths. The pork barrel system of waterway legislation so prevalent in the United States has put locks of varying sizes on the same stream, made a stretch of good navigation here and there that connected with nothing and leaves to us such monuments as the canal at Muscle Shoals on the Tennessee River. In 1908, 12,000 tons of freight passed through it at a cost to the government of $4 per ton for repairs and maintenance and $7.50 per ton for interest (at only three per cent) on the cost of installation. It may be that this democracy will permanently display insufficient intelligence to do this great work and that the pork barrel is here to stay. On the other hand, granted systematic construction and compulsory through routing of freight by the railroads, the waterways of the United States have a busy future.

The possibilities of the Mississippi River are enormous. The expensively improved and busy Rhine is a suggestive example. At the head of the navigable eastern branch of the Mississippi, the Ohio, is Pittsburgh, the capital of coal, iron, and glass, with the astonishing traffic of 150 to 200 million tons a year. Since 1920 the railroad congestion has driven the Pittsburgh steel manufacturers back to boats and the Pittsburgh district had 22 million tons of freight in 1922. These figures become more sig-

nificant when it is remembered that the United States has never yet produced 5 million tons of cotton or 35 million tons of wheat in one year The total world export of wheat was 22 million tons (1923) and the entire world's crop of wheat is about 80 million tons a year The Chicago Drainage Canal gives connection with the Great Lakes, and the Mississippi itself flows through the heart of the corn, oat, meat, and hay belts and reaches at Minneapolis the edge of the spring-wheat country and the greatest flour-milling center in the world. The continued neglect of such a waterway is an almost inexplicable waste of resource. We need less triple tracking of coal, wood, iron, and life-wasting railroads and more construction of resource-saving waterways for which the geographic conditions of the country are so favorable

QUESTIONS

1. What was the matter with George Washington's plan for a canal from tidewater on the Potomac to the Ohio River?

2 Compare the commercial future of Charleston and Galveston

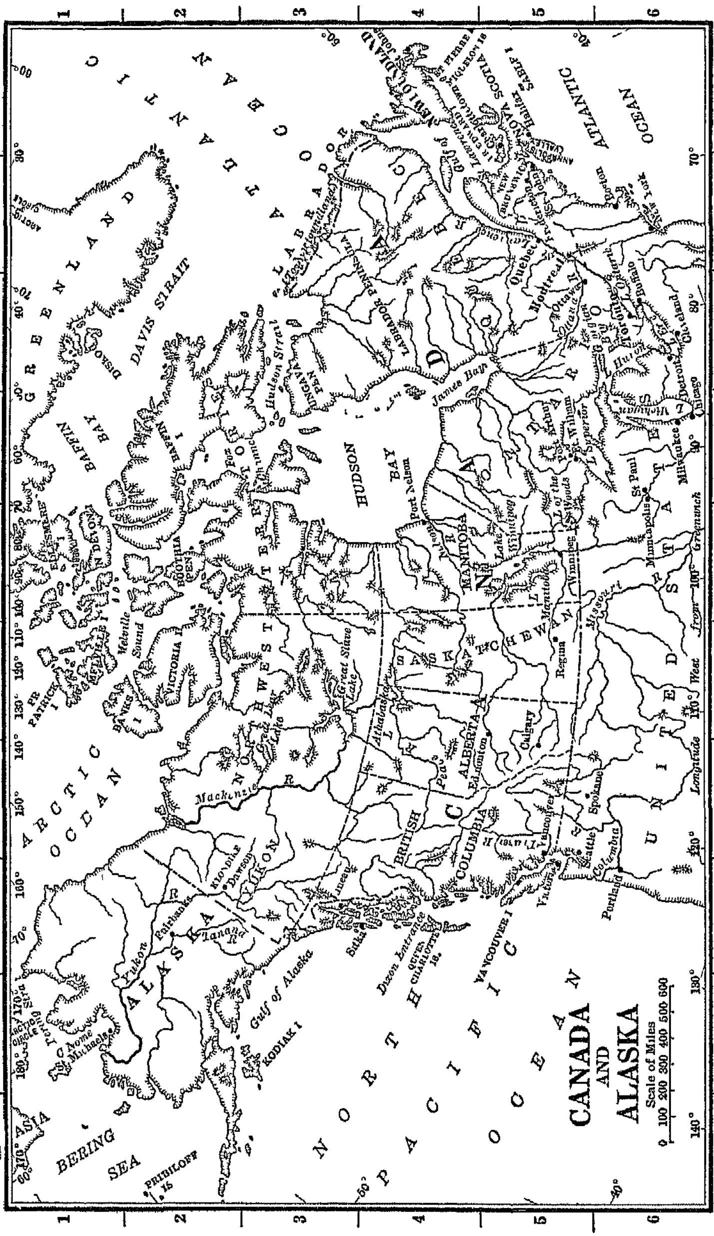
3 Which is needed more, the double tracking of some of the existing transcontinental railroads or the building of another one?

4 Compare the prospects for through traffic for railroads to be built from an Ohio River city to Mobile and to Norfolk—granted equality of freight rate

5 Compare the traffic future of San Francisco and Seattle

6 Why would the railroad traffic manager rather have a colonist settle in the Rocky Mountains than on the Pacific Coast?

7 What is the most important first step to get our waterways used?


CANADA
AND
ALASKA
Scale of Miles
0 100 200 300 400 500 600
ARCTIC OCEAN
GREENLAND
BAFFIN BAY
DAVIS STRAIT
HUDSON BAY
James Bay
Hudson Strait
LABRADOR
ATLANTIC OCEAN
NORTH PACIFIC OCEAN
BERING SEA
ASIA
ALASKA
YUKON
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
NORTHWEST TERRITORIES
ONTARIO
QUEBEC
NOVA SCOTIA
NEW BRUNSWICK
NEWFOUNDLAND
UNITED STATES
Gulf of Alaska
KODIAK I
PRIBILOFF IS
QUEEN CHARLOTTE IS.
VANCOUVER I
Dixon Entrance
Sitka
Juneau
Dawson
KLONDIKE
Fairbanks
Tanana R
Yukon
Mackenzie R
Great Bear Lake
Great Slave Lake
Athabaska L
Peace R
Edmonton
Calgary
Regina
Winnipeg
L. Winnipeg
L. Manitoba
Port Nelson
Nelson R
L. of the Woods
Port Arthur
Fort William
L. Superior
L. Michigan
L. Huron
L. Erie
L. Ontario
Georgian Bay
Ottawa R
Ottawa
Montreal
Quebec
Toronto
Buffalo
Cleveland
Detroit
Chicago
Milwaukee
St Paul
Minneapolis
Missouri R
Spokane
Seattle
Victoria
Vancouver
Portland
Columbia R
Boston
New York
Halifax
Fredericton
St John
Charlottetown
St Pierre
Miquelon Is
Sable I
Anticosti I
Gulf of St Lawrence
Belle Isle
C. Nome
St Michaels
ARCTIC CIRCLE
Bering Strait
BANKS I
VICTORIA I
PR PATRICK I
MELVILLE I
Melville Sound
N DEVON
ELLESMERE I
BOOTHIA PEN
BAFFIN I
Fox Channel
UNGAVA PEN
LABRADOR PENINSULA
DISKO I
Longitude West from Greenwich

PART II
FOREIGN COUNTRIES

CHAPTER XVII

CANADA

Canada an extension of the United States. To understand Canada one should remember that it is geographically the northward extension of the United States The glaciated and forested New England landscape with its meager agriculture, good water power, and fishing coasts, extends into Canada. The similarly forested and glaciated upper lake states are matched by more land of the same sort to the north of the Lakes The old lake bed that lies to the west of the Minnesota forests and makes the Red River Valley famous for wheat, has the greater part of its area in adjacent Manitoba The Great Plains of Dakota and Montana extend northward into Canada for hundred of miles, and owing to the better water supply there, they are undoubtedly a better place for grain growing (Fig. 199) The only important part of the United States along the boundary that is not duplicated in Canada is the open Columbia river basin The Canadian mountains here widen out so that with their forested slopes they cover most of the territory from the eastern front of the Rocky Mountains to the Pacific Most important of all is the similarity in race and in institutions, including government Except for the French population of Quebec, these too are in the main a continuation of those of the United States

Climatic limitations. The fact that Canada is farther north than the United States places agriculture, especially in the East, under a greater handicap This causes the fishing industry on the Banks, which are closer to Canada than to the United States, to assume an ever greater relative importance in the maritime provinces than in

New England Northward from South Newfoundland the sea is full of southward floating ice, the air is cold and damp, and agriculture is limited to gardens and even gardens are a rarity in Newfoundland Thus Newfoundland and Labrador offer one of the best modern examples of a people living from one resource—so great is their dependence upon fish. There is a little iron mining, a little lumbering, and some paper making, but two-thirds of the exports are fish products and three-fourths of the workers are busy with fish The people who are not at sea catching cod, or herring, are busy curing them Some of the cod are sold fresh, but most of them are cleaned and salted as soon as they are brought to the schooner by the dories, and when the schooner reaches its port they are dried in the sun upon sheds which stretch conspicuously along the coasts. The herring is salted or cured by smoking over a slow fire.

The fishing industry. The fishing industry of Nova Scotia equals that of Massachusetts, the leading fishing state of the United States, and the total Canadian catch ($49,000,000, 1920) is two and a half times that of New England. Nova Scotia with her many good harbors partakes somewhat of the character of Newfoundland but, though she catches over one-fourth of the fish of Canada, the warmer climate of this province enables the people to engage, to a considerable extent, in agriculture, and they ship sheep, cattle, and horses across the straits to the people of Newfoundland

Fishing fleets from Europe still visit the Grand Banks, and although Newfoundland belongs to Great Britain, the French fishermen may, by treaty right, fish along the shore of the greater part of Newfoundland. They may also land and dry their fish, although no permanent French settlements may be made France also owns two small islands, Miquelon and St. Pierre, situated just south of Newfoundland, with a population of a few thousand, dependent entirely upon the fishing industry. This single product serves to give these islanders an exceedingly heavy trade, many times as heavy per capita as that of the United States

A seal sought for its oil and leathery skin is common in Labrador and Arctic America, and a fleet of steam sealers sails from St. Johns, N F., on an annual fishing voyage. Single vessels have been known to bring back 30,000 skins.

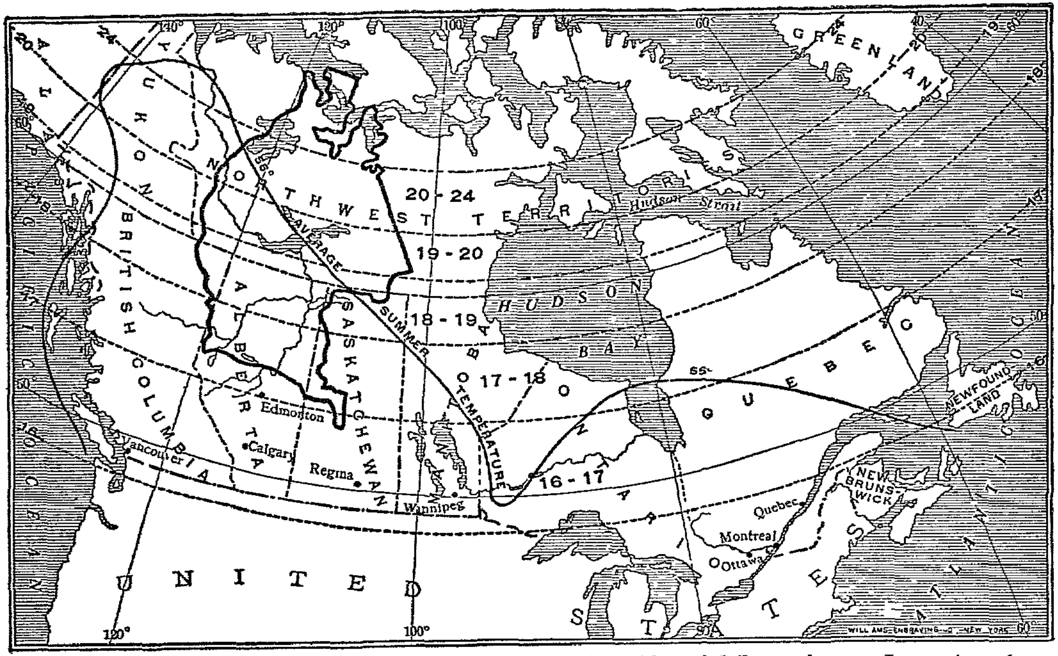


FIG 199 —Map of Canada showing by dotted lines the number of hours' daily sunshine in June A moderate summer temperature prevails in high latitudes because of the long days and short nights The space enclosed in black line shows the areas of the Siberian province of Tobolsk in its proper latitude, which produced in 1907 nearly 12,000,000 bushels of wheat This shows that Canada's wheat region may extend far to the north

The salmon of the Pacific rivers canned identically as are those of the United States are the most valuable fish of Canada

Agriculture of East Canada. The agriculture of East Canada like that of New England has been handicapped by the glacial topography and soil and almost wrecked by the competition of cheap products from the rich and level West. Where it has survived, it has been by intensification through dairying and the development of specialties. Thus the eastern provinces have become famous for their potatoes Starting in Prince Edward Island a suggestive new industry has become established throughout Canada The enormous prices paid for the furs of the black fox have caused eight million dollars to be invested in fox farming, and several thousand dollars has often been paid for a single fine breeding fox Again, in that part of Canada lying between Lake Huron, the city of Quebec and the American boundary, comprising the populous parts of the provinces of Ontario and Quebec, the people have reached a high degree of success in dairying The provinces of Ontario and Quebec with nearly 3,000 factories where butter and especially cheese are manufactured made over three-fourths of Canada's $100,000,000 worth of dairy products in 1922. Great care is taken to maintain high quality, and it is consequently much esteemed in Great Britain, whither 95 per cent of the cheese goes, making up half of the British import of that article Canadian competition, aided by the inferior quality and bad repute of American cheese, has greatly lessened the export of the American product.

Canadian apple growing. Canada is also an apple exporter of nearly as great importance as the United States. The apple does well from Lake Huron to the mouth of the St. Lawrence and two localities have utilized their especial advantages for developing the apple as a money crop for the foreign trade. The most famous of these is the Annapolis Valley in Nova Scotia (crop 1922 estimated 1,900,000 barrels) This valley 8 × 80 miles in the western part of the Peninsula is protected by the Bay of Fundy and a sheltering mountain range, and is well suited to the apple. There is an official record of one tree that yielded 35 barrels of fruit. These advantages, together with convenient access to the seacoast, relative unfitness for other forms of agriculture, and an early start at apple growing have given this region a development of the industry

which has made its product famous in Britain. The export apple is the chief money crop and financial dependence of its people. The second Canadian apple district, with an equally valuable crop, is near Niagara Falls on the peninsula between Lakes Erie and Ontario, where it has the protecting influence of the water similar to that which benefits New York's lake shore apple belt, of which it is really an extension separated only by the Niagara River It is surprising to think that this part of Canada is a better place for the growth of peaches and grapes than many parts of the United States

Manufacture. Canadian manufacturing is chiefly located in Ontario and Quebec For a long time it was unable to overcome the temptation of the people to emigrate to the western provinces and to the United States But the World War gave it a great boom and it is now nearly as valuable per person in Canada as it is in the United States. The cities of Ontario have banded together to make and sell hydro-electric power more cheaply than it can be bought in the United States. Many American companies have branches in Canada The unused opportunities for iron manufacture furnished by Nova Scotia coal and Newfoundland iron, both near tidewater, are almost unrivaled and the Nova Scotia iron industry is growing. Canada seems destined to develop large manufacturing because of her wealth in wood, iron, coal, and water-power.

Canadian forests. Four of the forest belts of the United States touch and extend across the Canadian boundary (see Fig. 141). The Pacific and Rocky Mountain forests combine in Canada, extend northward through British Columbia and on to the Yukon, a vast region crossed as yet by but two railroads, the Canadian Pacific near the United States boundary, and the Canadian National farther north, so that most of it is unsettled and some of it is even unexplored by any but the unscientific trapper and prospector It contains, along with some land good for agriculture, many forests that await the building of railroads to get the product upon the world's market. The treeless belt of the Mississippi Valley goes northward through Canada, until in latitude 60 the moisture conditions for forest growth are found and there is a connection between the Rocky Mountain forests and the forest region north of the Great Lakes in a subarctic forest belt 200 to 300 miles in width.

The whole of the country from near Winnipeg to the Atlantic

was originally a forest of which but a fraction has been cleared for settlement and that is all in the region between Lakes Erie, Ontario, and Lower Huron, and in the St. Lawrence Valley North of this small inhabited belt is one of the great forest reserves of the future reaching from the Rocky Mountains to the mouth of the St. Lawrence and from Hudson Bay to Georgian Bay, the Ottawa River, and the banks of the St Lawrence itself Much of it is up-

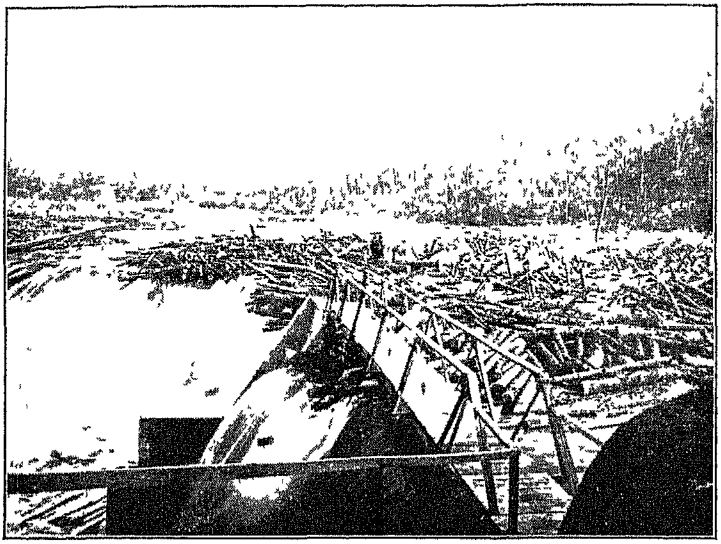


FIG. 200 —New Brunswick, Canada, has both logs and water power. (Natural Resources Intelligence Service, Ottawa.)

land, it is well sprinkled with lakes and marshes, and is practically unsettled except by a few Indians, fur trappers, and summer fishermen. A railroad has been built across it from the south end of Lake Winnipeg to Quebec, and branch lines have been built northward from the Canadian Pacific to reach silver and nickel mines in the Algoma district north of Lake Superior, otherwise this great forest is yet without industry save lumbering on its southern edge For this the Ottawa River gives a good outlet and the city of Ottawa is an important lumber producer and lumber market In its northern part this forest thins out through a wide area of

scrubby forest and bush to the Arctic timber, home of the caribou and reindeer Unfortunately these forests have suffered terribly from fire and the rate of growth of the trees is very slow

A continuation of the New England forests occupies most of the Canadian territory between the St Lawrence and the Atlantic. Forests cover much of interior Newfoundland, and wood products are the only plant products exported from that cold, foggy, and sparsely peopled island

There is extensive, but as yet almost unused, water-power on the many streams flowing from the lakes and swamps upon the large lake-strewn plateau between the St Lawrence River system, the Atlantic Ocean, and Hudson Bay The province of Quebec alone has, according to the estimate of the Canadian government, 11 million horse-power, Ontario 7 million and the entire Dominion 30 million It is nearly equal to the entire amount of artificial power developed in the United States Less than 10 per cent of the water-power of Ontario and Quebec is now utilized

These extensive forests with their water-power make possible an enormous industry in wood manufacture, of which paper is a type and already one of the important exports of the region. New mills are being erected in the entirely unagricultural lands north of the Gulf of St Lawrence and in Newfoundland Electric smelting of aluminum, nitrates, etc , is another industry that has begun and for which the water-power furnishes the current. Montreal, about the size of Pittsburgh, and Toronto, about the size of Buffalo, the leading industrial cities of Canada, are close enough to the water-power to use it in their rapidly growing manufactures. There is even prospect that the gigantic water-powers of the St Lawrence will be sent by wire to New England and New York

The western Canada grain country. The plains west of the Lake Superior forests are the new and now best-known Canada. Here is a vast level plain of almost unbelievable extent, and much of it still awaiting the settler to whom the last of it is still being given away in homestead tracts of 160 acres each. It extends from Lake Winnipeg to the Rockies (Fig 199) Day after day one may ride on new railroads across open, treeless plains where the new settlers are chiefly busy with continuous grain growing,

chiefly wheat, which may last for one, two, or three decades before they too must take to other crops and to cattle keeping. In the meantime the wheat crops on the virgin prairie soil of the harvest frontier are larger than those of the Red River Valley. It is possible that the Canadian region suitable for the extension of wheat growing reaches 60° north. If experience proves this to be true, the wheat-growing possibilities are enormous, and

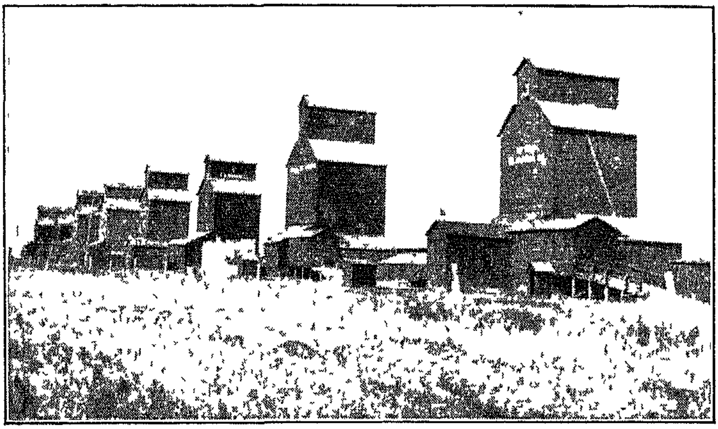


FIG. 201.—Grain elevators at railroad station on the agricultural frontier 101° W. The first stage in the journey of grain from the farmer's wagon to the distant user.

the continuous cropping method will have land to support it for several decades.

For several years prior to 1914 the building of new railroads across this Canadian plain went forward with great speed. Many thousand settlers came each year from Europe and from the United States. The Canadian government actually maintained bureaus of information in cities of the United States and advertised in Americian farm papers that she had farms to give away. This new settlement was checked after the World War because the price of wheat was low.

Winnipeg with a location near the end of a lake, as has Chicago, is the Chicago of the Canadian wheat country. It is already a hustling, thriving, booming metropolis with Regina,

Calgary, and Edmonton far beyond it to the westward rising in importance

Canada's rise as a wheat grower is indicated by the yield of Saskatchewan—four million bushels in 1900, 34 million in 1908, 121 million in 1913, and 250 million in 1922 There is as yet little reason to modify Dr Saunders' reasonable prophecy of 1904—that wheat grown on one-fourth of the land suitable to it in the Canadian northwest, with the acre yield of Manitoba for the previous decade, would bring a crop of more than 800 million bushels, which, as he shows, would feed 30 million people in Canada and supply three times the import need of the United Kingdom The remaining three-fourths of the land would provide room for a vast animal industry with soil-enriching crop rotations As the empty lands fill up with settlers the tendency in Manitoba, Saskatchewan, and Alberta—the three prairie provinces—is toward more diversified farming and live stock raising and less dependence on a single cash crop—wheat Occasional failures from drought, frost, hail, grasshoppers, and rust are driving them to diversified farming

British Columbia, the northward continuation of the climate and lands of Washington State, has enough fruit and agricultural land to support, if in Europe, a nation of second-class power Its minerals are valued at $40,000,000 a year and its fisheries, chiefly salmon, at half as much.

Mineral resources. Canada is not so blessed in mineral resources as is the United States Of the Appalachian coal fields there is no extension in Canada There is only a small coal field in Nova Scotia so that most of the St Lawrence basin is naturally tributary to the coal of Pennsylvania whence there is a large import.

Similarly the United States got the lion's share of the Lake Superior iron ores although recent discoveries show that Canada has large amounts in comparison to any possible home demand The destruction of all surface features of most of the land in the eastern forests by glaciation makes prospecting very difficult, but there have been great discoveries of silver and nickel

Parts of the western plain are underlaid by a deposit of coal that is probably larger than that of all Europe and is already of great service in driving the locomotives on the long railroads that connect

the new wheat lands with the steamers on the Great Lakes In drilling a recent artesian well near Macoun, Saskatchewan, 100 feet of coal were found within 1,000 feet of the surface The remoteness of this coal from large population makes it an interesting reserve for the future Meanwhile Canada's chief coal market is between Montreal and Detroit, and she imports more than she mines.

British Columbia also has some coal in the immediate coast district whence it was exported to California in considerable quantity before the California oil discoveries. There is some gold mining in the British Columbia mountains and a vast area of unprospected mountain country

Transportation in Canada. The settlement of this ready plain of West Canada caused a general industrial boom, and a tremendous development in railroad building before the World War Canada is a country of vast empty distances and the railroads have had to build up their traffic by first carrying settlers to raise crops, and then carrying out the crops It is not likely that the near future will see the construction of more trans-continental lines, but many additional branch lines will be built as population increases. Many thousand miles of railroad belonging to the government (the Canadian National) have earned no dividends for several years

The high freight rate on wheat from West Canada to the shipping ports at New York and Montreal has raised great hopes of utilizing the Hudson Bay Route for grain export. Port Nelson, on the western shore of Hudson Bay, at the mouth of Nelson River, is 100 or 200 miles nearer to Liverpool than is New York, and 1,400 miles nearer than New Orleans The New Hudson Bay Railroad, which the government has promised to complete, will make the wheat fields around Edmonton 400 miles nearer to Port Nelson than to Port Arthur, on Lake Superior. It is estimated that the rail and ship route, via Hudson Bay, will save the West Canada grain growers from six to seven cents a bushel on his wheat The Hudson Bay Route's advantage of distance is modified by the winter ice, which closes the passage to the Atlantic for the greater part of the year, and may possibly prevent any extensive use of the route. At present nearly all of Canada's commerce with Europe passes through the port of Montreal when the St. Lawrence is open, and through Halifax,

St Johns, N B, Portland, Me, Boston, and New York in the winter months when the St Lawrence is frozen A new transportation development has been the recent shipping of wheat from the western prairie provinces to Vancouver, whence it reaches the world markets by way of ocean vessels and the Panama Canal

The far country. North of these south Canadian lands of the white man is the greater part of her area that has for generations been the trading ground of the Hudson Bay Company which has posts and carriers to gather furs from the Indians For a long time this historic company, with such an interesting history, was both trader and governor but it has now given the governing over to the Dominion, although it still has a virtual monopoly of trade in hundreds of thousands of square miles of cold forest and still colder barren grounds beyond. The sparse population of Indians and a few French and Indian half breeds who live here gather a considerable share of the world's furs

This land of fascinating unmapped rivers abounding in fish and game remains in its primitive condition, with its primitive industry (For other possibilities see chapter on Extension of Industry)

Canada the complement of the United States. There are many commercial reasons why Canada and the United States should forever be friends We want her goods, she wants ours We even buy her wheat to mix with ours. We already want the wood pulp and lumber from her vast eastern forests and the chemicals and metals made by her water-power plants She wants our oranges and cotton, our coal, steel, and machinery to supply her needs and develop her resources We are her best customer, taking nearly half her exports; she is one of our best customers, buying two-thirds of her imports from us

QUESTIONS

1. Why do the fisheries of Newfoundland and Labrador seem more important than those farther south?

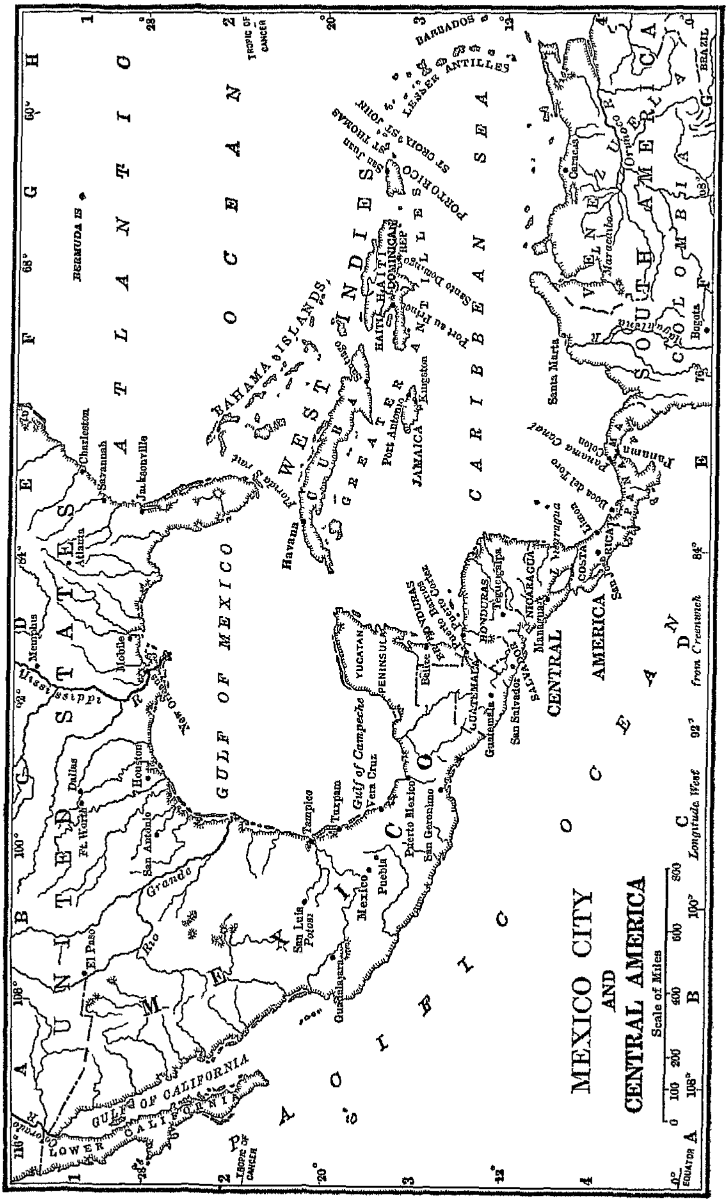
2 For what industry do two resources fit the plateau north of the St Lawrence?

3 What two sections of Canada are climatically fitted for apple growing?

4 Why may we expect west Canada to have a larger wheat yield per acre than North Dakota?

5 Why will west Canada have a greater advantage as a wheat producer than as a meat producer?

6. What types of manufacturing will Canada develop first?


MEXICO CITY
AND
CENTRAL AMERICA
Scale of Miles
0 100 200 400 600 800
Longitude West from Greenwich
ATLANTIC OCEAN
PACIFIC OCEAN
GULF OF MEXICO
CARIBBEAN SEA
UNITED STATES
MEXICO
CENTRAL AMERICA
SOUTH AMERICA
WEST INDIES
GREATER ANTILLES
LESSER ANTILLES
BAHAMA ISLANDS
BERMUDA IS.
CUBA
JAMAICA
HAITI
DOMINICAN REP.
PORTO RICO
ST. THOMAS
ST. JOHN
ST. CROIX
BARBADOS
YUCATAN PENINSULA
Gulf of Campeche
GULF OF CALIFORNIA
LOWER CALIFORNIA
GUATEMALA
SALVADOR
HONDURAS
BR. HONDURAS
NICARAGUA
COSTA RICA
PANAMA
Panama Canal
VENEZUELA
COLOMBIA
BRAZIL
TROPIC OF CANCER
EQUATOR
Mississippi R.
Rio Grande
Colorado R.
Orinoco R.
Magdalena
Florida Strait
Charleston
Savannah
Jacksonville
Atlanta
Memphis
Mobile
New Orleans
Houston
Dallas
Ft. Worth
San Antonio
El Paso
Havana
Santiago
Port Antonio
Kingston
Port au Prince
Santo Domingo
San Juan
Tampico
Tuxpam
Vera Cruz
Puerto Mexico
San Geronimo
Mexico
Puebla
San Luis Potosi
Guadalajara
Belize
Puerto Barrios
Puerto Cortez
Tegucigalpa
Guatemala
San Salvador
Managua
Limon
San José
Bocas del Toro
Colon
Santa Marta
Maracaibo
Caracas
Bogota

CHAPTER XVIII

MEXICO

Northern Mexico is the southward extension of the natural features that characterize the southwestern United States—arid plateaus broken or walled by high mountains The mountains of western Texas and of western Arizona extend southward, increasing in height until they meet south of Mexico City, which thus has its location on a walled-in plateau. While this city is in the tropics, its elevation of a mile and a half on the high plateau robs it of the tropic climate One needs a sunny room and blankets It is on this plateau 700 miles long and 200 to 300 miles wide increasing in height as it goes south that nearly nine-tenths of the Mexican people live As in Arizona, so in adjacent Mexico, mining is the chief dependence of the people and the chief basis of foreign trade On the higher mountains are pine forests, on the plateaus scanty pasturage and vast cattle ranches, and here and there irrigated oases of alfalfa, vegetables, corn, and cotton A little wheat is also grown, but cattle are the chief agricultural export of this plateau

Lower California, a peninsula 700 miles long, the extension of the dry land area of south California is almost a desert. It is on the leeward side of the continent in the zone of trade winds and there are few mountains high enough to make precipitation of value to agriculture It is a land of arid ranches with a few patches irrigated by mountain streams

Population and living. The population of all Mexico, one-eighth as numerous as that of the United States, is composed of two-fifths native Indians, two-fifths of mixed race and one-fifth of pure or nearly pure white race of Spanish stock. Most of the people cannot read and most of them are poor This is not good material for a successful democracy As the Spaniard prefers official and military life to industry, most Mexican industries except the simplest are operated by foreigners. Amer-

icans, English, Germans, and French plan the railroads, mines, and oil wells, and supervise the native peon in building and operating them. Foreigners also run many of the trains. The bulk of the native Indian or half-breed people have a very low standard of living. The simplest shelter suffices, and, rather than work much, they content themselves with a diet consisting chiefly of beans, one of the most easily grown of vegetables, and corn, the cereal which they can most easily and cheaply grow. Peppers and onions furnish flavor and variety. In Mexico and other Spanish-American countries the commonest form of corn bread is the "tortilla" or hot corn cake which can be baked over an open fire. Mexico has never succeeded in growing sufficient corn for her own needs. That part of the country north of San Luis Potosi is steadily importing more and more corn as its mineral resources and railroads give employment to workers.

Except for a few mines of low quality product, near the Texas boundary, there is no coal in Mexico, and the scant rainfall of the plateau limits tree growth. As a result fuel is very scarce, wood and charcoal are often hauled many miles on mule back from distant mountain to valley settlements. The destruction of the forests in many sections has been very thorough.

Tropic Mexico and the forest. On the outer slopes of the central plateau there are many delightful warm temperate valleys producing corn, beans, vegetables, sugar cane and export coffee, but most of southern Mexico and the eastern shore plain is fully tropic with enough rainfall to produce the much over-praised tropic forest (Fig. 202). The woods here as in other tropic forests are in great variety and many are of surprising beauty and hardness, but most of the trees are crooked and almost useless for lumber. They are often worthlessly soft and weak, and the good ones are almost always mingled with many other species which makes their removal a very difficult matter. This mixture of species is a striking and important contrast to the practically solid stand that exists in the pine or spruce forests of Maine, the fir of Washington, the cypress of Louisiana, or the oak of West Virginia. Those who gather tropic logs usually find but one tree of a kind in a place, surrounded by hundreds of useless specimens of other varieties. To make matters worse, the heavy rainfall and the heat produce such a wealth of

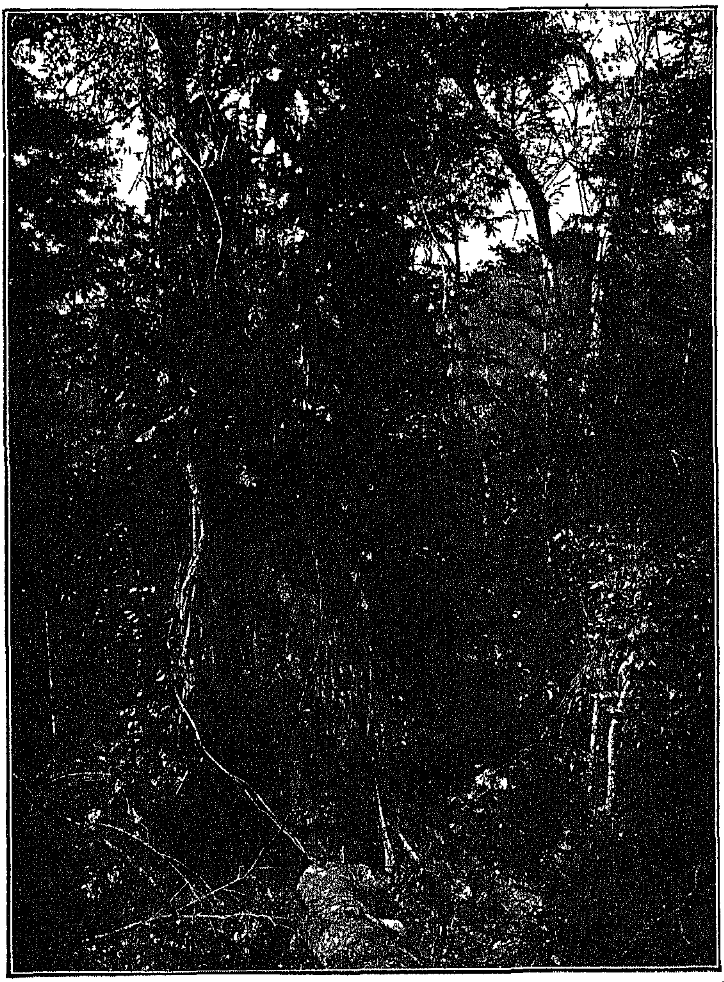


FIG 202 —Tropical forest in southern Mexico Good logs are scarce and industry quails before the task of extricating them. (Salisbury, Barrows, and Tower) Photo by W L Tower

bushes, small trees, and vines that a man can only force his way through by first cutting a path Thus the machete, a long-handled knife, is the most universal tool possessed by the inhabitants of many tropical countries. With it they cut paths through the forest in which each tree is often bound by creepers to a dozen others, so that the felling of one tree is a most difficult process. As the jungle is often swampy, the lumberman is tortured by insects, and it is evident that a wagon can rarely

FIG 203 —Cutting sugar cane in irregular valley on the west coast of Mexico A great litter of leaves, with good forage value is often left to burn or rot

enter to carry logs because the wheels would sink into the soft earth even if roadways could be cut. The nearest approach to the northern blessing of snow with its sled transportation is the annual floods of the rainy season, which permit the floating out of those logs which grow on overflowed land and are light enough to float Those that are heavier than water and most of the tropical cabinet woods with their great strength and beauty are heavier than water—must rot where they grow, or be dragged out at great expense Consequently, the chief timbers exported from the tropics are the mahogany and cedar (buoyant enough to float), of which the United States imported

banana The supply in Europe is inferior to that in the United States because that part of the tropics lying nearest Europe is the desert of Sahara, where the banana cannot grow The European supply has for a long time come from the Madeira, the Cape Verde, and the Canary Islands off the west coast of Africa, but within recent years fast steamers have begun to carry the product of the West Indies and Central America to England.

Importance of the banana in Caribbean countries. The nearness of the United States to the steaming hot plains that border the Caribbean Sea and the Gulf of Mexico has given us a favorable place from which to draw our supply of bananas Owing to the unwholesome climate along the Central American coasts, nearly all the people live on the more healthful interior plateaus and the best banana lands have long lain idle The comparatively new banana commerce, however, has caused recent rapid increase of settlements (mostly West Indian negroes, with white supervisors) and of commerce along the low eastern coasts American enterprise and capital have built railroads and established plantations near many of the ports and have sent ships to carry the product. When shiploads of bananas reach our ports, they are hurried on express trains to the interior As a result of this highly organized international trade, a hungry man on the streets of many American cities finds in the ripe bananas the best and cheapest portion of nutritious and palatable food within reach

This comparatively new trade has been little short of revolutionary in the effects it has had in making new industry in the vicinity of Boca del Toro, Panama, Limon, Costa Rico, Puerto Barrios, Guatemala, Port Antonio, Jamaica, Santa Marta, Colombia, and other Caribbean ports Four million bunches exported from Boca del Toro in 1921 made up three-fourths of the exports from the large territories of Panama There is room on the Caribbean for many more plantations as demand arises.

Drying the bananas, which has been begun in Jamaica, gives the possibility of producing the fruit in indefinite quantities because the ease of transporting the dried product will permit localities remote from port to send them to market. The banana is the chief export of Jamaica, but it is important in many places as a local food supply. Thus, the million inhabitants of Porto Rico who were supporting themselves almost entirely by agriculture, on a

hilly territory less than half as large as New Jersey, were upon the verge of famine for nearly a year after a West Indian hurricane in 1899 beat all their bananas to the ground. But within a year another banana crop had sprung up from the roots of the old plants Yet the Porto Ricans then as now did not export the banana largely It was a supply crop for home consumption while they produced coffee, sugar, and tobacco for the foreign market One

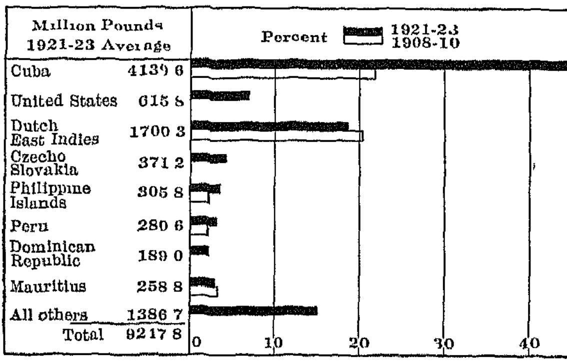


FIG 207 —World's sugar export, three year average

sees the sharp leaves of the banana plant in almost every mountain glen in that populous isle.

3 CUBA

Cuba has two great staples of export, tobacco and sugar It leads all countries in cane sugar, producing annually one-third of the world's crop; over half of all the cultivated land in Cuba is in cane fields, which shows the great dependence of the people upon this crop (Figs. 207, 209).

Cuban sugar plantations are usually of large extent, many of them owned by Europeans or Americans, chiefly Americans The use of portable plantation railroads with locomotives to haul the cane to large factories is quite common. The plantations are being enlarged, and improved machinery is being put in to reduce costs since labor cost is rising and the price of sugar declining During and immediately after the war, when the price of sugar was high, the Cuban sugar planters made fortunes, but in normal times the low price at the plantations leaves only a moderate profit

Cuba has been able to produce such great quantities of sugar because she has had a fairly stable government, a population superior to that of most tropic countries because largely Caucasian, an abundance of good, rich, well-drained sugar land, and is blessed with a climate that is almost ideal for sugar As only one-tenth of the sugar land is now in use, cane can be grown on this shiftless one-crop basis of the frontier farmer When land is exhausted the industry is able to move, generally to the eastward from Havana

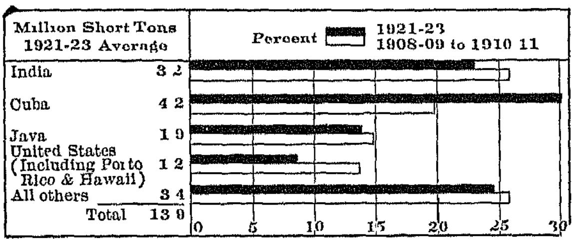


FIG 209—Production of cane sugar, three-year average

where the industry had its first center. The increasing labor scarcity is at present setting the limit of Cuban sugar growing

Cuban tobacco is famed throughout the world for its fine flavor, which gives Havana cigars their peculiar excellence The amount produced is about half as great as that of Virginia The Havana tobacco is the peculiar product of the south slope of the Sierra de Los Organos, a mountain range running from east to west throughout the whole length of the Province of Pinar Del Rio in the west end of Cuba. This tobacco is the one means by which the people of this district, called the Vuelta Abajo, are now able to buy products of the entire world. Innumerable attempts to grow the same quality of tobacco in other parts of Cuba and in other countries have resulted in failure, the nearest approach to success having been the shade-grown Florida product Most of the Cuban tobacco is used for cigars, and Havana is a great cigar-manufacturing center

4. Agricultural Specialties

In Porto Rico sugar is grown in the coast lands, and the advantage of the free admission of the crop to the protected American

market made great increase in the output since 1899. There was a corresponding decline in coffee from the highlands It had been shut out of Spain by tariffs after the annexation of the island to the United States There is some early vegetable growing in Porto Rico for the American market, and some tobacco is produced

The little worlds on the Caribbean have many examples of special crops and unusual conditions Thus Barbados presents the remarkable spectacle of 940 (it was 1,200) people to each of its 166

FIG 210 —Native house and unplowed corn patch in Panama on land that has been cleared, put in crop, and abandoned for a time and then re-cleared, for four centuries and probably many more The land has never been plowed and man's action has not aided erosion—a fact which on its conservation side puts American agriculture to shame (Photo H H. Bennett, United States Bureau of Soils)

square miles, living largely by agriculture, exporting sugar and growing most of their own food—yams, sweet potatoes, bananas, and vegetables Trinidad has an important export of cocoanuts, and asphalt from its asphalt lake, Montserrat and Dominica, with calcareous hills, grow limes for export, Jamaica pastures are shaded by the allspice tree from which the dried fruits reach our market as a spice In the Blue Mountains of Jamaica a very much prized variety of coffee is produced. The Isle of Pines, off the coast of

Cuba, ships crates of peppers, eggplants, and other vegetables to the American markets during the winter season It also produces and exports some fine grape fruit before those of Florida are ripe

5 Trades and Routes

The Caribbean countries, being alike in climate and resources, have almost no trade among themselves Nearly all commerce is with the United States and Europe (Fig. 208) Nearly all of the many steamer lines make a circuit of several ports. The lines from Europe usually enter at Barbados or St Thomas (both important coaling stations), while those from New York enter between Cuba and Haiti and call at La Guaira (Venezuela), Puerto Colombia, near the mouth of the Magdalena, Colon, and Kingston (Jamaica) Direct lines of steamers go from New York to Havana, Cuba, and San Juan, Porto Rico, also from New Orleans to the Central American ports, Limon and Puerto Cortez for bananas.

Fig 211 —The codfish from Newfoundland, dry as a bone, hard as wood, and keeping indefinitely is admirably fitted for the tropic market (Photo by Miss Helen Fogg)

The opening of the Panama Canal in 1914 caused a great increase in the amount of shipping that sailed the waters of the Caribbean. In 1923 traffic to the amount of 25 million tons moved through the canal, over half of it consisting of American coast-to-coast trade. This increasing canal commerce has little to do with the Caribbean

countries because most of the vessels go directly through. The Canal Zone, a strip of land on each side of the canal, has the advantage of being under a firm government from the outside, and also it has a great opportunity to forward produce to all parts of the United States and Europe.

6 THE GUIANAS

The Guianas do not touch upon the Caribbean, but since physiographically and climatically they are an eastward extention of Venezuela, they may be conveniently discussed here They consist of three small countries ruled by Great Britain, the Netherlands, and France respectively, with a total area of 170,397 square miles, somewhat larger than the state of California They have a hot, moist, densely forested lowland backed by an escarpment rising to a plateau covered with tropical vegetation and savannas, and inhabited by a sparse Indian and negro population

The British Colony of Guiana is one of the most interesting of cane-sugar producers, showing intensive cultivation and the untouched wilderness side by side. Considerable areas of coast swamp have been reclaimed from the sea along the north shore in the same way the Dutch (the original settlers of Guiana) have done in Holland This is the more unusual because most of the country remains a great forest absolutely uninhabited, save for a few forest people The explanation of this unused land is to be found in the climate which is so ill suited to white colonists that they number but five per cent of the total population and merely occupy the government positions and manage the stores and plantations In the attempt to people this fertile desert and work the productive soil, the government has permitted the recent importation of thousands of East Indian coolies accustomed to growing rice and sugar cane This has led to the rapid increase of rice-growing along with the continuance of sugar-cane growing which has been for many years the main export product of this colony The reclaimed swamp land is very fertile, has a large rainfall, and, in addition, the flat and level dyke lands are easily irrigated for both sugar and rice. Further than that, the drainage ditches serve as canals for the boats that carry the cane from field to factory.

Dutch and French Guiana differ from British in that they have no East Indian immigrants, and less industry A small amount of balata gum, a material for chewing gum, is gathered by the forest people and exported.

QUESTIONS

1 Why is this region one of such varied industrial conditions?

2 Why do coffee, hides, and gold fit into the foreign trade conditions of Colombia?

3 How does Guiana show that the poor condition of Colombia is not due to the Spanish race?

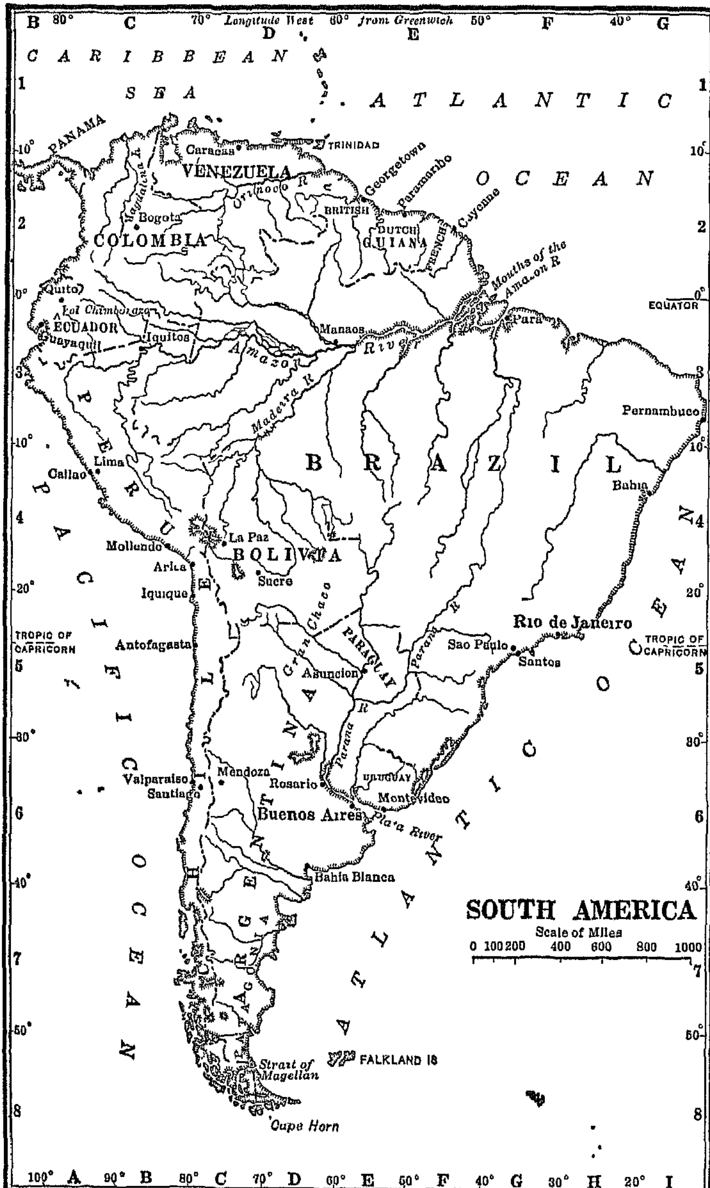
4 What does Jamaica show about the future of the white race in the tropics?

5 How has the steamship influenced the banana trade more than it has the sugar trade?

6 What two races are chiefly engaged in the Central American banana industry?

7 Why do other countries not compete with Cuban tobacco growers as they do with the sugar growers?

8 What is the most remarkable thing about Barbados?


SOUTH AMERICA
Scale of Miles
0 100 200 400 600 800 1000
Longitude West from Greenwich
CARIBBEAN SEA
ATLANTIC OCEAN
PACIFIC OCEAN
TROPIC OF CAPRICORN
EQUATOR
PANAMA
TRINIDAD
Caracas
VENEZUELA
Orinoco R
Georgetown
Paramaribo
Cayenne
BRITISH
DUTCH
FRENCH
GUIANA
Bogota
COLOMBIA
Magdalena R
Quito
Vol Chimborazo
ECUADOR
Guayaquil
Iquitos
Manaos
Amazon River
Mouths of the Amazon R
Para
Madeira R
PERU
Lima
Callao
BRAZIL
Pernambuco
Bahia
La Paz
BOLIVIA
Sucre
Mollendo
Arica
Iquique
Antofagasta
Gran Chaco
PARAGUAY
Asuncion
Parana R
Rio de Janeiro
Sao Paulo
Santos
CHILE
ARGENTINA
Mendoza
Rosario
Valparaiso
Santiago
URUGUAY
Montevideo
Buenos Aires
Plata River
Bahia Blanca
PATAGONIA
FALKLAND IS
Strait of Magellan
Cape Horn

CHAPTER XXI

THE RIVER PLATA COUNTRIES

Climatic conditions. The countries on the River Plata, Argentina, Uruguay, and Paraguay, comprise a region rich in sheep, cattle, wheat, corn, and alfalfa, and find their closest duplicate in that part of the United States between the Mississippi and Missouri Rivers and the Rocky Mountains Argentina alone is half as large as the United States As in any agricultural region, one must know the facts of rainfall (see Fig 3), and to understand this it is necessary to note the main facts of the winds Southern South America has, south of latitude 35°, the prevailing westerlies which drench the west coast and give scanty rain to Patagonia, the region east of the mountains As we approach the tropics the southeast trade winds blow from the south Atlantic, giving to Uruguay, Paraguay, and a part of Argentina some of the same abundant rainfall that blesses southern Brazil Between these two rain-blessed areas is a large arid strip (see Fig 3) which comprises much of Argentina and crosses over the Andes to make the deserts of North Chile and Peru

Parts of this region, Mendoza for example, being under the same world wind system that gives the California (Mediterranean) climate (mild, rainy winter, hot, dry summer), produce the same products—scanty pastures on that great proportion of the land that cannot be irrigated and on the rest, alfalfa, dried fruits, European grapes, and wine Unfortunately the arid area is large, but, as in the trans-Missouri region, it merges on its eastern edge into a wheat belt and then into a corn and alfalfa belt, which unfortunately does not extend south of latitude 39 Like our own prairie and plains country it was unforested, covered with good grass, and very accessible to the settler. It was as though the American settlers had landed from ship at Dallas, Texas, Kansas City, or the southeastern corner of Montana

The live stock industries. Fifty years ago, when there was a great demand for haircloth, herds of horses valued at $2 50 each

were driven into pens twice a year by their owners to have their manes and tails clipped to furnish horsehair for the crinoline looms in England and France. Then came the merino sheep, whose wool and tallow, skin and bone also went to Europe, while his meat was thrown away because there was no possible market for it. Later came the refrigerator ship resulting in the export of mutton. The pastures of the Parana Valley are so fine that the sheep fatten entirely on the rich pampas grass

Cattle and sheep. In addition to being a natural pasture, this plain seems to be very well adapted to growing alfalfa This makes

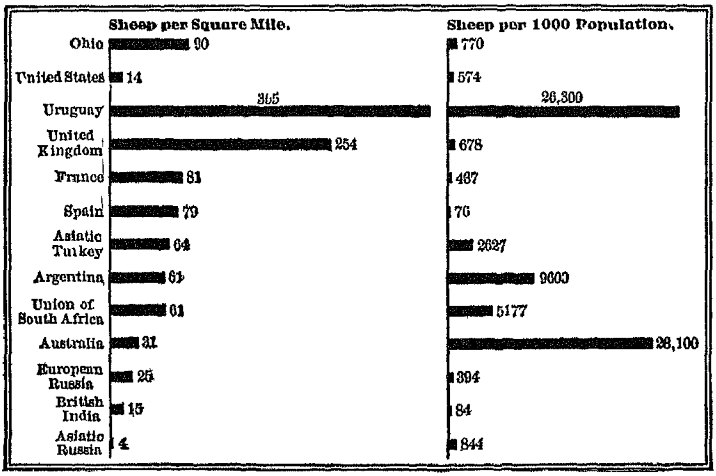


FIG 218 —Ratio of sheep to land and to population, in leading countries.

it one of the finest places in the world for sheep and cattle, for alfalfa is the best of foods for these animals, and it makes possible an increase of their number from three- to six-fold when it replaces natural pastures The mild open winter, a characteristic of the southern hemisphere, permits the animals to run at pasture without sheltering barns

For every person in the country there are three head of cattle (five in 1912) and five sheep (10 in 1912) (Fig 218) (see chapter on Animal Industries, compare United States), and the meat allowance of the gaucho, or half-breed Indian cowboy, is five

pounds per day, as much as many European families have for a month

The temperate climate of Argentina makes it a white man's land that is now receiving heavy immigration from Spain and Italy. More than half the people are white. Its capital, Buenos Aires, the largest city in the southern hemisphere, is a fine Europeanized city, nearly the size of Philadelphia though the total population of the country is less than eight per square mile. Owing to the

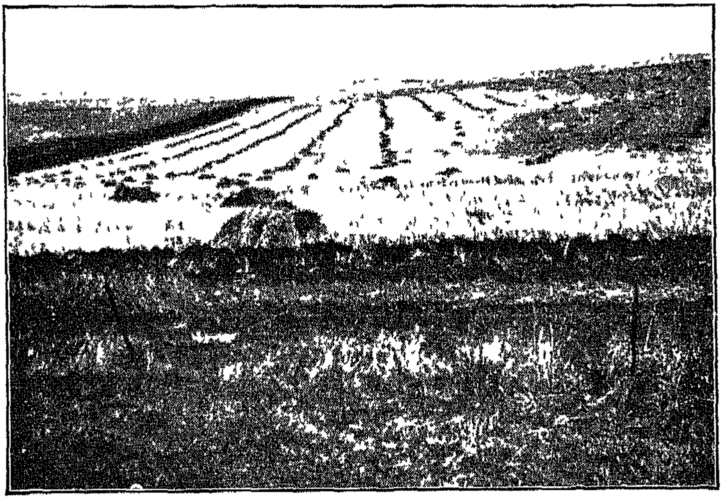


FIG 219 —An Argentina wheat field (Photo by W Webber, courtesy International Harvester Co)

progressiveness of the Argentine ranchers, the live stock industry is as modern as the capital. European breeds thrive and many thousands of dollars are paid for prize-winning specimens of English sheep and cattle to be used as breeding stock. Now that the refrigerator ship can carry meat to Europe and the United States, there is great attention to beef breeds of cattle and mutton breeds of sheep with their coarse wool This change from wool to mutton varieties is very disconcerting to the manufacturers of fine wool cloth who had previously secured fine merino wool there.

Influence of refrigeration. Before the invention of refrigeration the sheep industry of the Parana or River Plata countries produced wool, skins, and hogsheads of tallow, and perhaps bones if they were worth picking up at the price and the place The cattle industry had advanced beyond the shipment of hides, tallow, and bones by the manufacture and export of tasajo and beef extract Tasajo is a peculiarly well-preserved kind of dried beef cured in the sunshine of the great pampas pasture plains It has the quality of keeping

FIG 220 — Load of Argentine wheat on way to market (Photo by W Webber, courtesy International Harvester Co.)

indefinitely in such hot, humid climates as Cuba and Brazil, so that transportation becomes easy. For many years tasajo has had a wide distribution over tropic America

Fresh meat goes in shiploads to Europe, and because of the increasing scarcity in the United States, regular shipments of Argentina meat to New York began in 1913, ceased during the World War, and began again after its close Our import promises to continue

The jerked beef (tasajo) industry of Argentina and Uruguay migrated to Paraguay and Brazil when the World War increased the demand for frozen and canned meat

Wheat. For many decades the Argentine ranchers imported their flour About 1870 wheat growing began and increased so rapidly that Argentina soon became a great exporter The resources are magnificent This fertile treeless plain is one of the most level and most easily tilled tracts of land in the world (Fig. 219) In one place a railroad runs 278 miles in a perfectly straight line, and the traveler can ride for two days on a train and see nothing to break the flat line of the horizon Here the Italian immigrant, mostly a tenant-farmer, grows wheat with American machinery in the usual one-crop land-robbing way of the frontier, which produces large yields for a short time. Already the wheat export of over 100 million bushels a year makes Argentina for the present

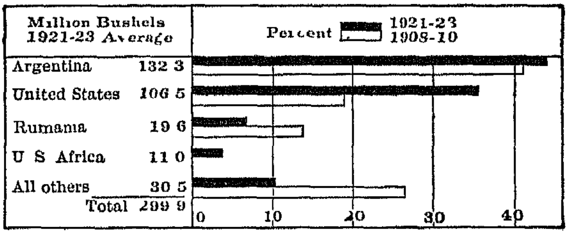


FIG 221 —World's corn export, three-year average

one of the four leading wheat shippers of the world, along with the United States, Canada, and Australia. The proportion of the crop exported is significant In 1922 the United States exported 25 per cent of her crop, Canada 69 per cent, and Argentina 75 per cent. There is great room for the expansion of the crop (Fig 220).

Corn. The people of Argentina, about as numerous as those of Illinois and Iowa combined, have of late begun to grow corn The country exports at the present time a larger proportion of its corn crop than any other country of the world (Fig 221), because the people do not yet use it largely as food, and for the fattening of live stock alfalfa generally suffices. During the period 1919 to 1921 Argentina exported 128 million bushels per year, or over one-half her crop, while the American export of 89 million per year was less than five per cent of the total crop. The possibilities for the relative increase of corn production are probably better in the Parana Valley than in any other corn zone, because of the sparse

population and the large area, of which only a tenth is yet in cultivation. The present production is about equal to that of Nebraska As compared with the United States there is, however, a disadvantage in the less regular rainfall, which will be a permanent hindrance to great production because of the uncertainties of the harvest Thus the fine crop of 1905, 195 million bushels, and nearly 30 bushels to the acre, led to enlarged plantings the next year, but the crop fell to 72 million and the yield to 13 bushels per acre This caused a reduction in the area planted Unfortunately, such weather fluctuations making crop fluctuations seem to be normal there.

Patagonia is a frontier country of low rainfall, like the drier part of our own Great Plains, too low for grain growing, but suitable for sheep ranches The climate is such that the sheep do not have to be housed The country has been settled by British people from the nearby Falkland Islands. Many of the sheep ranches of Argentina, like most of the railroads, belong to British capitalists, while many of the slaughtering plants of the eastern cities belong to the same persons as do those of Chicago and Kansas City.

Forests. In the northeastern part of Argentina, corresponding to the forested region near the mouth of the Mississippi, but reaching nearer the equator, is the Gran Chaco—an extensive, unsettled, tropical forest containing much quebracho wood (the name means axe-breaker) The tree is medium-sized, with a very hard wood containing 20 per cent or more of tannin, which renders the wood almost indestructible in the ground, thus making it very valuable for railroad ties. Its richness in tannin (no other plant rivals it) has caused a rapid increase in the shipment of the Argentine extract to the tanneries of England, France, Germany, and the United States, over 50,000 tons of extract and a like amount of logs being imported by the United States in 1922 There is a great supply of quebracho in Argentina. One tract in the Chaco gives employment to 30,000 workmen and also produces cattle, a fact that indicates the destruction of the forests Since the wood is heavier than water and is very difficult to get and transport, the extracting plants are, like sawmills, located as near as possible to the place where the trees are cut. When used alone the quebracho extract makes

inferior leather, but in combination with other materials, its results are better.

The absence of any good coal or available water-power, the possession of great land resources, and the small population, indicate that Argentina will remain an agricultural country, for which it has a great future

Uruguay, across the Parana River, from the most productive part of Argentina, is from end to end an undulating grassy plain closely resembling Nebraska in population and area. There are a few grain growers raising wheat, corn, and flax, near Montevideo, the capital, but twenty times as much land is devoted to sheep and cattle pastures. The importance of the live stock industry to Uruguay is shown by the fact that animals and their products make up over 95 per cent of the exports. While Uruguay will remain a grazing country indefinitely, it is slowly advancing toward the second stage of man's use—grain growing Its agricultural development is held back by terrible droughts. In 1916 one and one-half million cattle perished because of droughts. Clouds of locusts also fly down from the Gran Chaco and the Brazilian forests almost every year and eat every green thing in their path. Sometimes the army is called out to fight them

The capital, Montevideo, with ten steamers arriving every day, has more shipping than Marseilles, the chief port of France. Nine-tenths of the Uruguayans are white No other South American country, save Argentina, has over half its population of pure white ancestry

Paraguay. This tropic country, beyond the Argentine part of the Gran Chaco, of which it also owns a part, has four times the area of Cuba, but only one-third as many people They are mostly of mixed Indian and negro races, with a few Spaniards, and have suffered greatly from wars. Owing to the tropic climate, it has not shared the European immigration that has come to Argentina and Uruguay Much of the country is in forests or in large cattle ranches, cattle being as numerous in proportion to people as they are in Argentina, while hides and meat are among the important exports Owing to the moist tropical climate, sheep are almost non-existent, but there is an important commerce in oranges and early vegetables that go by steamer

to the cities down the Parana, which is the sole commercial outlet of the country Oranges are used for fattening hogs in locations where shipping facilities are not good

A rising export of Paraguay is maté, the dried leaf of a bush of the holly family. It is much used as tea in the four countries adjacent to the Parana and is now being exported to Europe, where its use is increasing Tobacco is also exported to Europe

Trade and routes. It is easy to see why the fertile plain of Argentina to the west of the lower Parana and Plata, low, healthful, of easy access to the sea, rich in sheep and cattle, wheat and maize, possesses the best railway net in South America The foci of these lines are the ports of Buenos Aires, Bahia Blanca, and Rosario Rosario has such good natural harbor facilities that grain sacks slide by gravity down chutes from the warehouse on the bank to the steamer in the river. Buenos Aires, with a very shallow river, has an artificial harbor with splendid docks and warehouses that compare well with anything in America. Its harbor possibilities are said to be much better than those of New York It is as busy as New York

Westward from longitude 64° west, where the rainfall is insufficient for agriculture, the network of railways gives way to a few single lines going directly across the plains to the irrigated districts at the foot of the Andes Two of these roads lead to the northwestern province of Tucuman, the sugar producer, 900 miles from the Atlantic ports A third railway is the Trans-Andean line, finished in April, 1910. It shortens by many days the winter journey between Buenos Aires and Santiago, which had previously required a steamer journey through the Straits of Magellan because the mountains could not be crossed Nearly all the railroads of the Plata countries, also their street car lines and electric light plants and meat packing plants, are owned by foreigners.

A new port, Bahia Blanca, has been developed to the southwest of Buenos Aires. It is a kind of Galveston to the Argentine—a southwestern exporting point

From the Plata ports of Rosario, Buenos Aires, and Montevideo, there are many and frequent steamers sailing to the United States and Europe (Fig 222), the great markets for their agricultural products and the sources of their supply of manu-

factures. From England alone are imported a million tons of coal per year, from the United States shiploads of agricultural machinery and pure bred live stock. This trade promises to

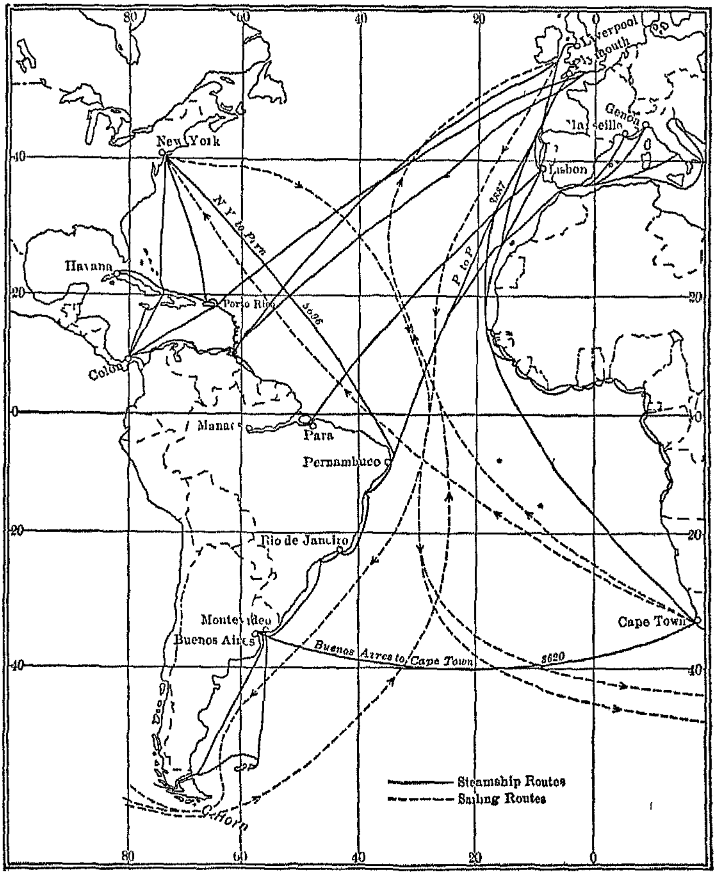


FIG. 222 —The vessel tracks of the Middle and South Atlantic.

continue, for these countries are new, with little capital, sparse population, and much land. If they should contemplate manufacture it will have to be with fuel from the northern hemis-

phere for there is not 1/500th as much coal mined in all South America as in the United States and almost the only water-power is a small amount on the Andes and a large amount near the southeastern boundary of Paraguay—a location of no present value The Plata countries are peculiarly devoid of known deposits of workable minerals.

QUESTIONS

1 What is the cause of the great difference in the rainfall of eastern and western Argentina?

2 How does it happen that Argentina exports a larger proportion of its wheat than does the United States? Of corn?

3 For what climatic reason do the European immigrants prefer Argentina to Brazil?

4 Is it easier to export wheat from Argentina than from Saskatchewan or Montana?

5 What change have they made in the kind of sheep grown on the Argentine ranches?

6 How have the Argentine forests lessened the gathering of tan bark in the American forests? [What other use is made of the principal Argentine tree and why?]

7 If we liken Argentina to Nebraska, what state does Paraguay become?

8. Why did a German firm manufacture beef extract in Uruguay many years ago?

9 What city in eastern North America is the same distance from the equator as Buenos Aires, Asuncion, Rio Janeiro, Bahia Blanca?

CHAPTER XXII

THE ANDEAN COUNTRIES

Topography and climate. The Andes Mountain system runs without a break through Colombia, Ecuador, Peru, Bolivia, and Chile—extending as far south from the equator as Sitka, Alaska, and north Scotland are to the north of it As a barrier to man's activity, it is second only to the Himalayas Through most of its length there are several ranges enclosing a plateau between them. In Chile the elevation of the plateau descends until we have a great valley resembling that of California. Though not so extensive as the California Valley it has the same climate and its products are the same and its people are vigorous and energetic in this wholesome cool climate Toward the equator, as in southern California, the rainfall declines, and the tremendous wall of the Andes shuts off the trade-wind moisture so absolutely that the Pacific Coast off South America from the tropic to near the equator is desert, in places the most rainless desert known.

When we consider that this plateau region is cut off from the sea by swamps as in Ecuador, or desert in Peru and north Chile, and that the plateau is separated from this forbidding coast plain by precipitous trails that no wheel ever climbed for over three and a half centuries after the white man came, we begin to understand why the countries are backward. Further, the people of the plateau are nearly all Indians who were fearfully abused by their Spanish conquerors and made to work the gold and silver mines to enrich Spain. Since they gained their independence from Spain there have been many wars and revolutions, so it is a land which geography and history have combined to keep undeveloped. But the climate is much better than that of most countries in tropic latitudes.

Desert industries. The rainlessness of north Chile and the Peruvian coast has caused the collection of large deposits of

guano and nitrate of soda, which would otherwise have been dissolved by rain and carried away Guano, an accumulation of the dried excrement and dead bodies of birds, is highly prized as a fertilizer and was exported in great quantities. These guano deposits of sea birds on the bare rocks called the Chincha Islands, off the coast of Peru, yielded $600,000,000 between 1830 and 1880, but are now about exhausted, only an annual product of 40,000 to 50,000 tons a year is now available

The method of mining the nitrate of soda is simple. After the removal of a little sand and earth from the surface, it can

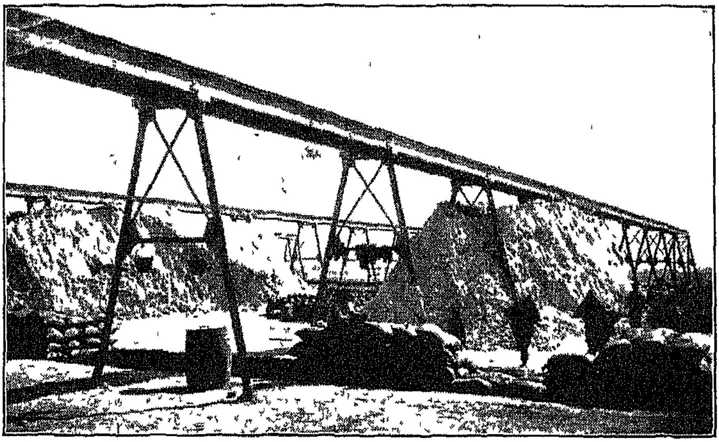


FIG 223 —Putting nitrate into bags for shipment

be shoveled up like clay and gravel (sometimes needing a little blasting) and taken away in carts or temporary railways to the nitrate works, where it is dissolved in water, boiled down and crystallized A by-product of the nitrate industry is iodine, a valuable chemical, and Chile having a practical world monopoly of both nitrates and iodine at the present time, limits production, and fixes prices almost at will It is doubtful if in all America we have a trust that is so thoroughly monopolistic.

While there is a large and growing output of copper in nearby districts, the nitrate fields produce two-thirds of Chile's exports By export duties on nitrate they produce most of her revenue,

and by their food demands, most of her domestic trade The nitrate towns have been enabled to secure a water supply by laying pipe lines to the Andes, sometimes more than 100 miles away. But the desert destroys all possibility of any local food crops. Everything for the use of man and beast in the nitrate fields must be imported, so that Iquique, the nitrate metropolis, a city of 37,000 inhabitants, Antofagasta, and many smaller ports and nitrate works, are depending upon the farms of central Chile, several hundred miles to the south of them, for every potato, cabbage, bale of hay, or loaf of bread necessary to support the daily life of these thousands who are extracting from the desert the nitrate accumulations of the past (Fig 223) The same dependence upon distant foods applies to the nitrate, manganese, and borax works in the same vicinity but across the boundary in southwestern Bolivia The desert miners sell minerals in Europe and the United States, these countries send manufactures to central Chile to pay for the food and forage sent thence by coasting steamers to the dwellers in the desert "The meat supply for nitrate camps of northern Chile is derived by driving herds of live animals from Salta and Jujuy in northern Argentina The animals are driven summer and winter over passes 15,000 feet high, where they sometimes have to spend 3 days without food in the desert."[1]

The United States imports 300,000 to 400,000 tons annually of the nitrate, about a fifth of the whole Most of it goes to west Europe, Germany has long been a good customer, using it mainly in her beet fields

The arid region of northern Chile is rich in copper as well as nitrates, and Chile is second only to the United States in the production of the red metal. The mines, which are owned largely by American copper companies, have not as yet been worked to any great depth

The rainless Peruvian shore plain is crossed by a number of streams fed by the Andean snows and which flow for over half the year. By means of irrigation this narrow strip of desert, nowhere more than 90 miles wide, is enabled to grow the two major export crops of Peru, cane sugar and cotton The cotton

[1] From Isaiah Bowman, *Bulletin American Geographical Society*, Vol XLVI, March, 1914.

is a peculiar brown in color and of a curly character that fits it admirably to mix with wool Irrigated rice, introduced by Chinese immigrants, is everywhere grown as a local food crop.

The Ecuadorean shore plain is a great contrast, for a part of it is in the doldrum belt of heavy rains and is as damp, forest clad, and unhealthy as any trade-wind coast Guayaquil, the chief port, has long been troublesome as a pest center In the 20,000 square miles of forest there is a little gold digging, a little coffee growing, some gathering of palm nuts for export to the button factories, but the chief export has arisen from the excellence of the locality for the production of cacao Ecuador has long been one of the main sources of the cocoa and chocolate of commerce She has plenty of room to grow more but the labor supply is scarce

"Some idea of the magnitude of the cacao crop may be gained from the fact that the main streets of this city (Guayaquil) are almost wholly occupied by cacao beans, placed there to undergo the necessary curing process, and the wharves are covered to a height of several feet with the beans in bags ready for export. The enormous yield is the result of the increased acreage and greater number of trees planted in the last few years "[1]

The Andean plateau on which most of the people of Ecuador, Peru, and Bolivia live is another world It is mostly from two to three miles above sea level and while it is by latitude in the tropics, it is by temperature so cold that in places the natives of Bolivia wear wool masks to protect their faces from the biting winds The elevation is so great that a European child taken there is likely to die in a few hours. As the rainfall of much of this region is slight, there are no trees, but potatoes are grown for local use, and there is a scanty pasturage Such a climate is the natural home of fleece-bearing animals and wool export fits admirably into the conditions of pack train transport. There are several million sheep and considerable numbers of three native wool bearers, the llama, the vicuna, and the alpaca. Two of these, the llama and alpaca, furnish for export some very fine, long, soft wool, but the animals themselves have never appealed to the people of other countries as suitable for

[1] *The Journal of Geography*, December, 1914, p. 126.

propagation The llama, a small animal resembling both the sheep and the camel, is used for carrying packs, which cannot exceed a hundred pounds in weight (Fig 224) He is sure-footed and can pick his scanty living like a camel It is possible that the llama might be a source of profit in some other mountainous regions

Metals are the great commercial resource of the plateau, especially in Bolivia and Peru The silver mines of Potosi are justly

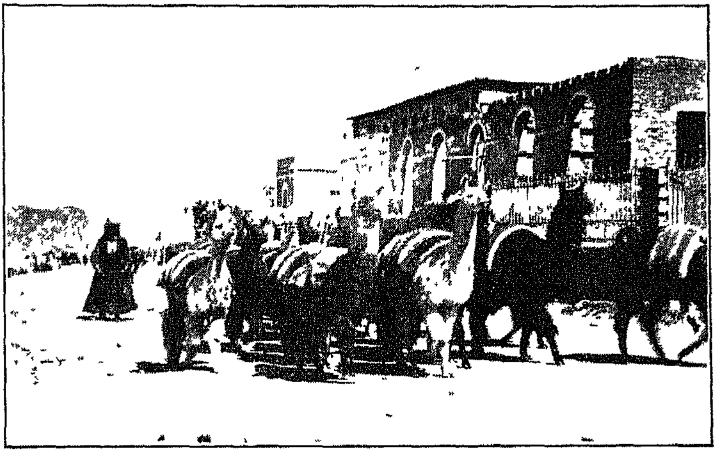


FIG 224 —The Llama A beast of burden in Andean countries

famed for their almost fabulous riches while the Cerro de Pasco district of Peru furnishes a large and growing export of copper Yet this region, like the rest of South America, is practically undeveloped, and the recent construction of railroads from the Chilean ports of Antofagasta and Arica, and Mollendo in Peru, permitting the introduction of mining machinery, promises great developments The tailings left in past centuries often make good mining for well-equiped modern enterprises Bolivia is one of the foremost tin producers of the world, and copper and gold are also found in many places There is a little coal near the Peru-Bolivian boundary, but the quality and quantity both have much to be desired and the coast ports are still coal importers.

Before the discovery of America this plateau and also the shore plain of Peru were the home of dense population with advanced industry and a complex civilization that has left many interesting remains

Life on the Ecuadorean plateau. The difficulties of Andean travel and the service that the railroad is rendering, and will increasingly render, is shown by the conditions and the recent changes that have occurred in Ecuador The equatorial climate of the plains causes the center of Ecuadorean population to be in the enclosed plateau, about 40 by 300 miles, lying between the ranges of the Andes, containing the world-famous volcanoes Cotopaxi and Chimborazo. A temperature of 50° F at night is common, blankets are much in evidence and the climate is no more tropical than that of San Francisco Here nearly a million people lived until near the end of the first decade of this century, entirely cut off from all communication with the commercial world, except by a pack trail descending from the 10,000-foot plateau by perilous ledges, and crossing swamps that often become impassable in the rainy season A 350-mile railroad has at last been constructed by American capital from Guayaquil to Quito, the capital It opens no new trade routes, but is revolutionizing the methods and commerce of an old one. It makes possible, for the first time, the participation of these people in the world's commerce. This road practically annexes to the commercial world a new province containing a million people who have been living in the homespun epoch Their commerce is likely to be of limited extent because they live in the temperate zone climate of the high plateau where the country is so rough that there is small likelihood of their having any surplus of wheat, corn, or beans to send any farther than to their neighbors of the tropic plain, if perchance they can compete even there with temperate zone breadstuffs Their exports are, therefore, likely to continue largely of hides and wool, a little rubber from the eastern forests, and minerals, of which the country claims considerable store The imports comprise the whole list of manufactures and supplies needed in a modern city and in a surrounding farming district.

The region east of the Andes. Ecuador, Peru, Bolivia, and Colombia have trackless eastern territories in the Amazon Valley from which they have been cut off so absolutely that the Peru-

vian governors sometimes go out to their port at Iquitos on the upper Amazon by way of Callao, Panama, New York or Lisbon, or Liverpool and Para Great amounts of water-power might be developed on the Amazonian headwaters that make the 10,000-foot descent from the plateau In Bolivia some of the eastern plain is pasture land, and a railroad has recently been built around the falls of the Madeira River so that 3,000 miles of navigable streams on its headwaters are connected with Para

The opening of the Panama Canal has aided enterprises in the Andean countries which had formerly carried on most of their commerce by steamer around South America

Questions

1 How does it happen that the west coast is so dry at latitude 15° south and so wet at latitude 1° south?

2 How has aridity made north Chile rich?

3 What are the points of resemblance between Chile and an American state?

4 Explain the three-cornered trade of agricultural Chile

5 Why is the Andean plateau a natural place for the production of wool?

6 Did the Spanish exhaust the mines in the 16th, 17th, and 18th centuries?

7 What resources has the Andean plateau region for electric smelting?

8 Why are hides well suited to the foreign trade of the Andean countries?


WESTERN EUROPE
Scale of Miles
0 5 10 20 30 40
ICELAND
FAROE IS
SHETLAND IS
BRITISH ISLES
NORTH SEA
Edinburgh
Newcastle
Belfast
Dublin
IRISH FREE STATE
Liverpool
Sheffield
Manchester
ENGLAND
London
Bristol
English Channel
ATLANTIC OCEAN
Bergen
Christiania
Stockholm
Skagerrack
Kattegat
DENMARK
Copenhagen
GULF OF BOTHNIA
FINLAND
BALTIC SEA
Danzig
Hamburg
Bremen
Elbe
Oder R
POLAND
Berlin
Magdeburg
Essen
Cologne
Rhine
Amsterdam
Hague
Rotterdam
Antwerp
Brussels
BELGIUM
Roubaix
Lille
Havre
Amiens
Rouen
Reims
Paris
Seine R
LUXEMBOURG
SAAR BASIN
Mannheim
Strasbourg
Baden
Danube
Prague
CZECHOSLOVAKIA
Pilsen
Vienna
AUSTRIA
Basel
Bern
SWITZERLAND
Geneva
L Lugano
L Como
L Garda
Trieste
YUGOSLAVIA
Milan
LOMBARD PLAIN
Po R
PO VALLEY
SAVOY
Genoa
ADRIATIC SEA
Loire R
FRANCE
BAY OF BISCAY
Lyon
Rhone
Bordeaux
Marseilles
Cantabrian Mts
Bilbao
CORSICA
ELBA
Rome
ITALY
Naples
Barcelona
SPAIN
Madrid
Valencia
PORTUGAL
Lisbon
Almaden
BALEARIC IS
SARDINIA
MEDITERRANEAN SEA
Palermo
SICILY
Cadiz
Malaga
Almeria
Strait of Gibraltar
Gibraltar
AFRICA
Longitude East from Greenwich

CHAPTER XXIII

THE UNITED KINGDOM

(With Introductory Comparison of United States and Europe)

I. Europe and United States Compared

Climate and General Comparison. Europe is roughly the size as the United States, but its climate and surface give more good farm land than the United States. Our western mountains, aided by the Mexican land mass, wall off more than a million square

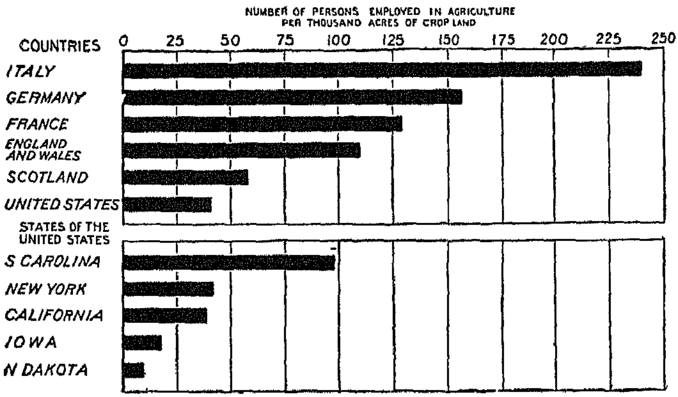


Fig 225 —Why does Europe use more men and fewer machines than the United States? South Carolina uses more hand labor than Iowa or North Dakota Why? (United States Dept Agr)

miles of our western country from the possibility of a good rainfall. By great good luck the geologic forces turned the great mountains of Europe (Pyrenees and Alps) so that they run east and west, letting the west wind blow moisture through the heart of Europe, making it a land of good farms rather than of poor ranches.

Then the same friendly geology placed the Mediterranean Sea

south of west Europe, whereas we have only the near-deserts of Mexico

Therefore, the United States has several times as much cowboy land as Europe, and correspondingly less crop land

FIG 226 —Rainfall, June, July, and August (After Mark S. W Jefferson)

Heavy—more than 10 inches of rain and melted snow in the three months

Light—from 6 to 10 inches in the three months

Scant—less than 6 inches in the three months

This map shows Europe's splendid rainfall No other continent is so uniformly blest

Another result of the Mediterranean is that Europe (and also North Africa and West Asia) has a much larger area of the California climate than the United States has (see Chap. XXXII)

Europe has no counterpart to our great cotton belt, gift of the Gulf of Mexico.

Europe is much farther north than the United States London is eight hundred miles north of Chicago The comparison of the latitudes of places on the two sides of the Atlantic shows great European cities opposite the unexplored wastes of Labrador This results from the southwest winds which blow the warm waters of the Gulf Stream northeastward toward Europe. The winds then warm themselves by the water and then go on to warm Europe Thus west Europe has a climate so warm that there are winters when London has no snow and sheep regularly winter on the pastures of Scotland

As the ocean does not get very warm in summer, the westerly winds give west Europe a cool summer It is claimed that this climate is the most invigorating of all climates—with its moderately cold winter, moderately cool summer, and frequent changes in temperature as the rainstorms pass It is the climate which has made the European races so energetic that they have explored, colonized, conquered, and built so much more than the natives of any other continent

Agricultural products. Partly because Europe far exceeds the United States in the proportion of the area that has sufficient rainfall for agriculture (Fig. 226), but chiefly because the population is four times as great as that of the United States, the agricultural output of Europe is much greater than that of the United States The United States and Canada have 78 million cattle (83 million before the World War), Europe has 125 million (129 million before the World War) In other branches of agriculture the figures are as follows

	United States and Canada		*Europe*	
	1922	*Pre-war*	*1922*	*Pre-war*
Hogs	72 million	67 million	70 million	73 million
Sheep	41 "	58 "	156 "	176 "
Horses	23 "	27 "	36 "	43 "
Wheat	1,255 million bu	941 million bu.	1,269 million bu	1,926 million bu
Corn	3,070 " "	2,740 " "	385 " "	585 " "
Oats	1,831 " "	1,780 " "	1,722 " "	2,598 " "

The United States has more of all of these products per person than Europe, and it is probably true that the United States has greater possibility of supporting people than Europe, because we

have the large area of our South with the long growing season, high temperature, and summer rain, permitting, if needed, the growth of from two to four crops per year. This, with its summer drought (Mediterranean type of climate), south Europe cannot do except in those small and favored locations where a little tract of land can be irrigated. The United States also has another advantage in the ability to grow corn. Most of north Europe is too cool for it, and in its stead barley, beets, and turnips, are grown in vast amounts for stock food.

Agricultural methods. The effect of the density of European population shows itself in the laborious preparation of rough land for garden agriculture by terracing, in the great cultivation of the potato in north Europe (see chapter on Potato and Vegetables), and in the very limited use of pasture because the ground yields more in cultivated crops. For this reason the cattle are commonly kept in barns except where the ground is too rough or too wet to cultivate. As a result of these conditions the sheep flocks of Europe have declined greatly in number in recent decades, and the land is being used for breadstuffs, beets, and hay, while the easily transported wool and meat comes from distant pastures on the frontiers of agriculture.

Forestry is another result of the density of population. Wild forests as we have in America would suffice for timber but little better than wild animals would suffice for meat, so they are carefully and systematically managed and protected from fire, giving a much greater yield than the wild and burned forests. This the United States is just learning to do.

Labor supply and manufactures. In the greater dependence on manufactures we see another result of the density of population. The young man in Holland or Belgium cannot find an opening in agriculture unless he replaces some one or engages in a more intense kind of farming.[1] His alternative is to get a factory job or emigrate. Hence the great European strife for markets for factory output, the great emigration, and the great and terrible land-hunger and land-grabbing that in part lay back of the fearful

[1] One must not get the impression that there are no unused agricultural resources in Europe, for there are surprising undeveloped agricultural resources in parts of that continent, especially England, France, Spain, Portugal, Turkey, and Russia.

European war of 1914 We see this greater dependence on manufacturing taking the same forms of intensity that we find in agriculture—the making of a refined and much labored product, fine goods, and instruments, not reapers—lace, not unbleached cotton

Trade. Any commercial comparisons of Europe and the United States are apt to be misleading unless we should think of the trade of the United States as it would be if it were cut into twenty independent pieces with one big piece between the Mis-

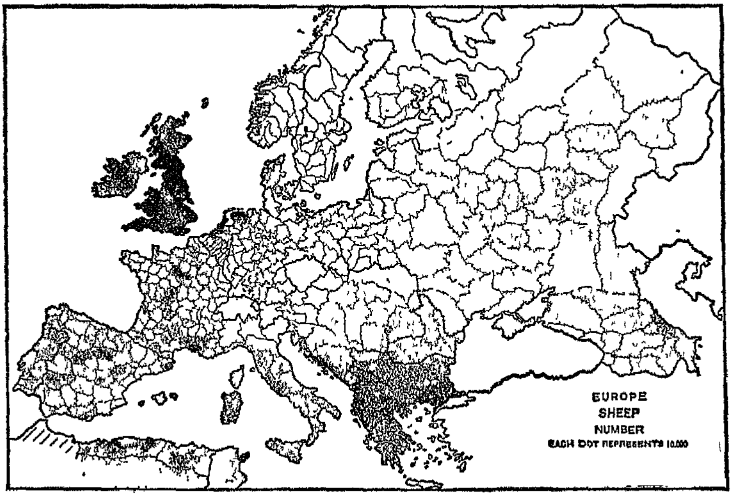


FIG 227 —The value of sheep in humid Britain, semi-arid North Africa, and the rough and semi-arid Balkans, is apparent (United States Dept Agr)

sissippi River and the Rocky Mountains to take the place of Russia A shipment of butter from Wisconsin to New York is local trade, from Denmark to London is foreign trade, of oranges from Spain or Italy to Berlin is foreign trade, from Florida to Chicago is local Most of the vast foreign trade of Europe, so-called, has in the United States as in China a counterpart of unrecorded local trade, because the United States and China are continental in size and resources

In matters of race and government the differences between United States and Europe are trivial, save for the fact that Europe

has the frictions that result from many languages and nations. The one great difference between United States and Europe may be summed up in one word, opportunity, and that means resources—resources with which the people can work The conservation movement in the United States is therefore one of the most vital things that has happened. The lament is that it is heeded so little.

2 The United Kingdom

The United Kingdom has been for a century and a quarter the greatest manufacturing country in the world, but she was a great

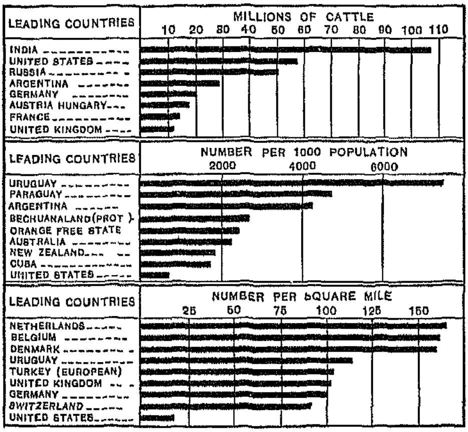


Fig 228—The great number of cattle per square mile in Europe is dependent upon over-sea trade Each year the newer countries of the western hemisphere ship millions of tons of forage grains, corn, bran, cottonseed, and linseed meal, and other feeds to west Europe.

agricultural country for many centuries before that, is one now, and will be more so in the future. The British climate is oceanic, much like that of our north Pacific Coast, and it is one of the best in the world The prevailing westerly winds coming from the ocean give a mildness to the winter and a coolness to the summer unknown in the United States east of the Rocky Mountains where the climate is continental rather than oceanic. This cool evenness of climate with little extreme weather and light snow fall permits sheep to live all winter in the open, even in Scotland. This climate

is undoubtedly a strong contributing factor to the Briton's love of outdoor sports for which his climate is much better than that of New York or Chicago. The British Isles have even more rainfall than is necessary for crop production. The heavy fogs of the English winter season are proverbial.

Live stock. Along with comfort and wholesomeness is an abundant and evenly distributed rain. The crop failures of Argentina or Uruguay are unknown If rain interferes with British agriculture, it is usually by too much rather than too little rainfall, and that produces a fine growth of grass which has made England rich

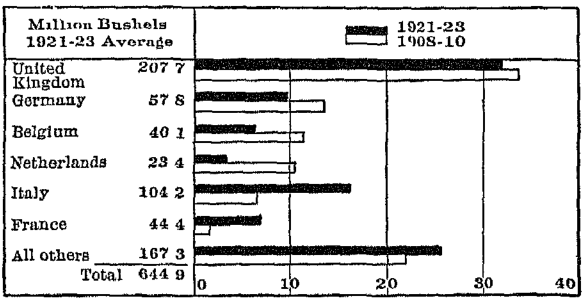


FIG 229 —Wheat and wheat flour imports, three-year average.

in flocks and the foremost country in the world in the production of breeds of domestic animals. The names of the breeds of sheep show their British origin—as Lincoln, Dorset, Southdown, Hampshiredown, Oxforddown, Leicestershire, and Highland The judges of the highest English court have for centuries sat upon a wool sack—symbol of the commercial importance of that commodity, which for many centuries was the chief export of England in the time when Holland and Flanders were the great wool manufacturing center of Europe

Many breeds of cattle and horses also bear British names, including the Shetland pony (Fig. 230), a dwarf produced by a meager diet[1] of heather and grass on the cold, raw hills of the Shetland Islands

[1] In many parts of the world a scanty food supply has produced local breeds of ponies, just as the abundant food of England and France has given us the big heavy draft horses still occasionally seen on city streets.

Grain growing. With a wheat yield per acre more than twice as heavy as that in the United States, Britain shows that she is an excellent country for the small grains. The hills and the rain of northern and western England, Scotland, and Wales, and the rains of Ireland cause wheat growing to be of small importance in those parts of the United Kingdom Eastern and southern England are the chief British wheat districts With their suit-

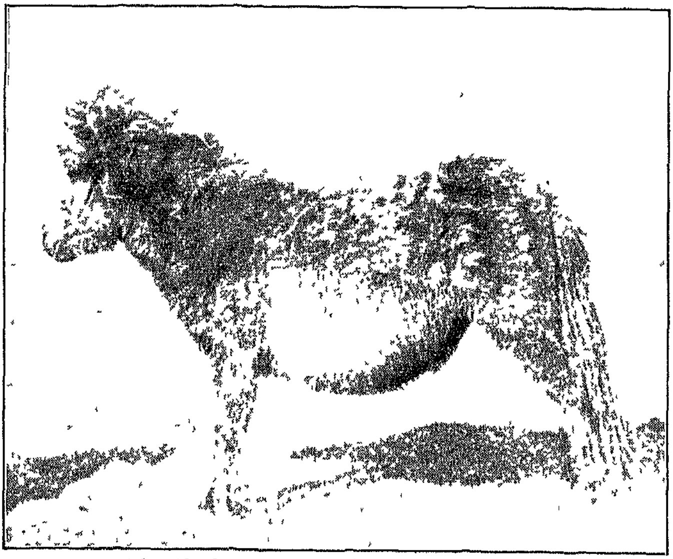


FIG 230—The Shetland pony with its long coat is an interesting response to an environment, the cold raw Shetland Islands (Photo C S Plumb, Columbus, O)

able climate, level plains, and fertile soil these districts are equal in wheat output to any corresponding area of the United States.

Oats and barley are largely grown for animal food, and Irish bacon is even imported to the United States because the meat of the barley-fed hog is so much leaner than that of the corn-fed hog of the American corn belt Because oats will stand more moisture than wheat this crop is grown in the wetter west and northwestern parts of the United Kingdom.

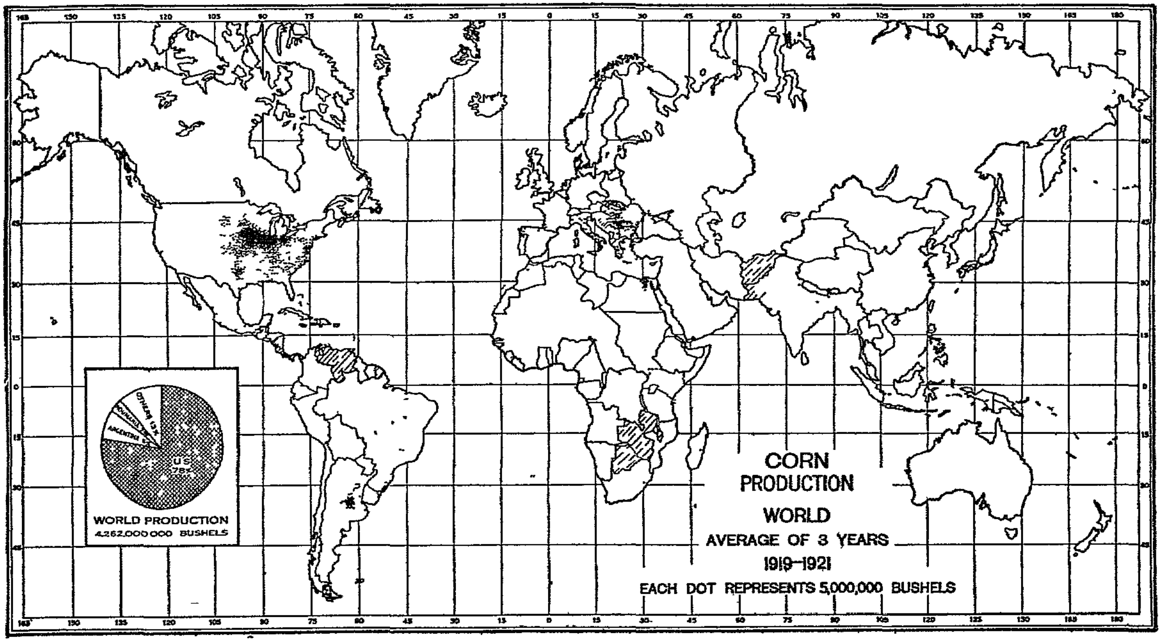


Fig 231 —The world map shows the leadership of the United States in corn and the smallness of Europe in this great crop This makes clear the basis of the great export from America to Europe of corn and its derivatives, pork, lard, and beef European climate is fine for small grains, but forbids any large corn area (United States Dept Agr)

Forests and pasture. England's access to seaports has enabled her to import wood for a long time, so that she has less forest (see appendix) than any other important country. Instead of forest, her hills and even her mountains, such as the Scotch highlands, are sheep pastures, and the heavy rain promotes a thick covering of grass, fern, and heather, so that the soil is held intact. Similar pasturage of French mountains where the rainfall is less, has resulted in such rapid erosion that tree planting had to be done on an

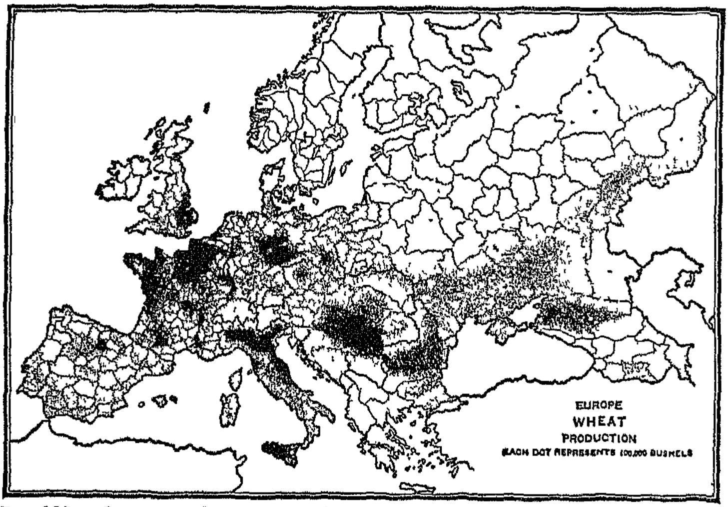


FIG. 232.—Compare wheat areas of United States and Europe to see how good Europe is. (Finch and Baker.)

extensive scale to hold earth on the slopes. The English people prize mutton, especially British mutton, and Great Britain, with one-half as many sheep as people, has more sheep in proportion to population than the United States.

The condition of agriculture. The United Kingdom was practically self-supporting in food until the origin of the factory system, and the consequent development of cities early in the nineteenth century (Fig. 229). Then followed a long political fight for free import of foods (cheap food), which resulted in British free trade about 1850. Then followed, from the Mississippi Valley, that same

deluge of cheap grain and meat that so depressed farming and farm values in the states along our Atlantic seaboard (Fig 234) As there is much unused land in New Jersey and Virginia, so is there, from the same cause, much unused land in England, although the recent rise in the price of foodstuffs before the World War caused the British to become more interested in agriculture as were the people of the eastern United States Still, England has only about six per cent of her population following agriculture while France has

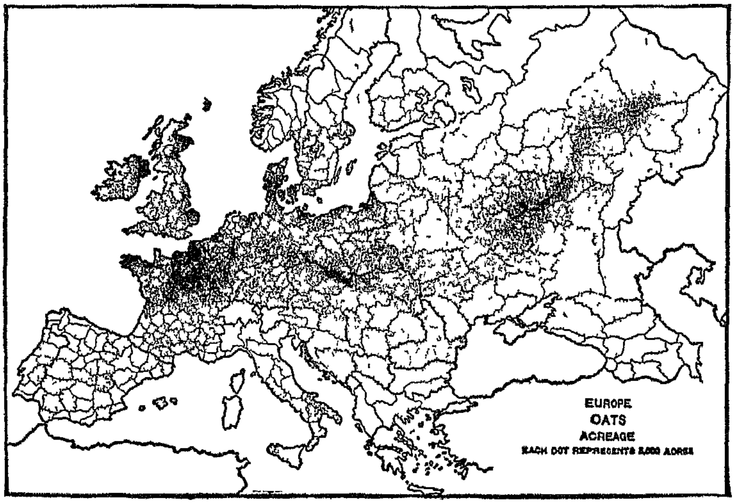


FIG 233 —Europe is also rich in her oat area. (Finch and Baker)

40 per cent This revival of agriculture is very marked in Ireland where Sir Horace Plunkett has rendered a great service by the establishment of cooperative societies that have guaranteed the quality of eggs and butter produced by the members, and thus greatly increased the demand for the products This help was sorely needed, for this island, devoid of coal, has not had the manufacturing development that has taken place in England and Scotland Ireland, called the Emerald Isle because of the greenness of her well-moistened pastures, is chiefly engaged in the export of meat and dairy products to English cities Much of England also is in pastures producing mutton and milk for her city

millions, so that the 60 million bushels of wheat she produces is but a fraction of the bread requirements She could grow much more grain than she does. In Germany one-quarter of the area is in grain In the United Kingdom it is about one-eighth

In addition to the import of bread and meat, Britain has a heavy import of cheese and of butter from Denmark, France, Canada, and New Zealand, and of fruits and vegetables from the Mediterranean countries. Since bread and jam is an important article of British diet there is also a large manufacture of jams and preserved fruits. Examples of serious overproduction of small fruits in Great Britain give surprising verification of the menace of overproduction in agriculture (see chapter on Potatoes and Vegetables).

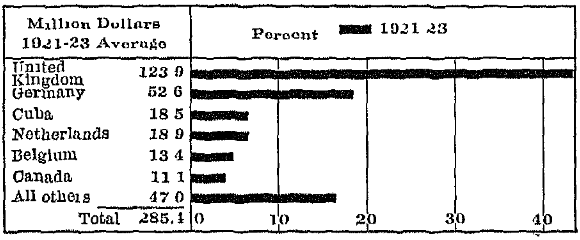


FIG 234 —Distribution of United States exports of meats, three-year average

Being thus dependent on imports, a blockade of her coasts would starve her into submission in a few months Hence her feverish insistence on a navy larger than that of any possible enemy

Coal and iron. England's twentieth century condition results from the fact that in the nineteenth century she led all nations in the abundance of capital and the ease of getting out her coal and iron These factors resulted in the development of manufactures England, already a coal user when the steam engine was invented, quickly took from Holland the leadership in power development, and then in manufactures, because she has large fields of good coal (Fig 235) (bituminous) near to the sea and near to the iron, which is necessary for the harnessing of power derived from coal. England's supply of coal is estimated to be sufficient to last six centuries at present rate of consumption. Holland was coalless and had to depend on the wind for power. England had, in addition to power, and adequate labor supply, a stable government, and

domestic peace. With these advantages the modern factory system quickly originated It came after a number of mechanical inventions in the latter part of the eighteenth century made it possible to assemble many workers in one building where their machines could be run by a common engine Previously, the English manufacturing had been done by hand machines in the cottages of people who lived in populous country districts and tilled some land. But coal and steam made easy the establishment of the factory system, and brought together these people into cities, usually to their physical injury, changed Britain from an agricul-

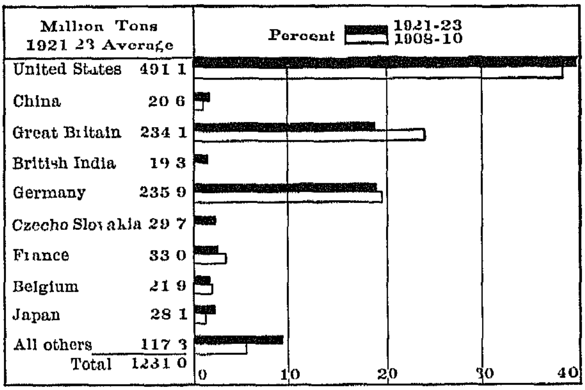


FIG 235 —World's coal production, three-year average

tural to a manufacturing country and transferred the center of population and power from the agricultural southeastern plains to the rougher, more mountainous north-northwest and west with their coal and iron

The examination of the map of the well-distributed British coal fields shows (Fig. 236) how the well-known manufacturing cities have arisen by them.

The possession of good iron ores lying beside these coal deposits quickly made England the leading iron-making country in the world. The location of the iron and coal fields on the east and west coasts of England and the southwest coasts of Scotland and of Wales, gave easy access to the sea for export, and later, when the ore supplies ran low in England, it was easy for the English iron

industry to turn to a supply of imported ore from the mountains near the north coasts of Spain and from northern Sweden

Textiles. Iron made the machinery, coal drove it, and caused England to lead the world in manufacturing by machinery, especially textiles For more than a century the name of Manchester has been synonymous throughout the commercial world with cotton cloth. That city, the metropolis of Lancashire, has long been the center of the greatest cotton manufacturing district in the world. The industry, established there as early as 1640, was partly due to the Atlantic winds which gave the moist air necessary to the best cotton manufacturing Later these same Atlantic winds influenced the industry through the water-power of numerous small streams that descended from the central highlands and led to quick development after the invention of the new machines. Both of these advantages have now passed away The moisture, like the temperature of the factory air, is now machine-controlled and the factories of Lancashire have long since outgrown the water-power and turned to steam, for which the local coal fields are very convenient. The third factor in Lancashire's start was the convenient harbor of Liverpool, which has long had wide ship connection with regions producing and consuming cotton The city of Manchester itself has now ceased to be so strictly a manufacturing city, and has become the sale and storage center for the product of many surrounding towns (Fig 238). Liverpool, the natural port of entry for this region, is the greatest cotton port in the world because back of it lies the greatest cotton-manufacturing district. It is, indeed,

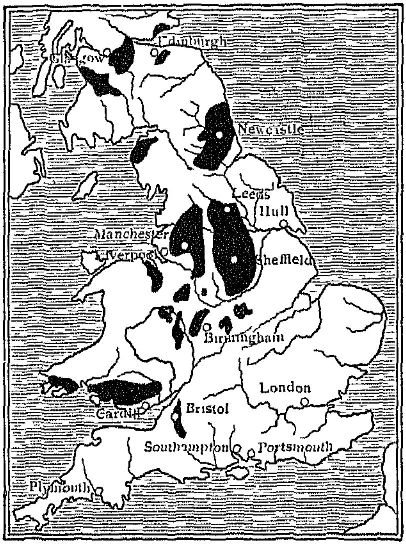


FIG 236 —Coal map of England

surprising that in a century and a quarter, the British cotton industry should have spread so little beyond a radius of 40 miles from Manchester. This district clothes Britain with one-fifth of its output, the other four-fifths being for world export (Fig 241).

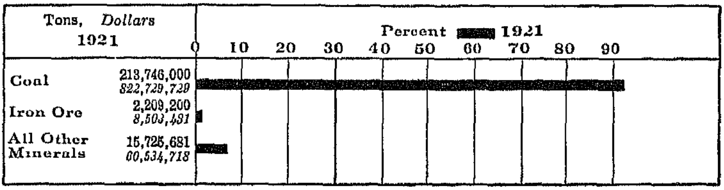


FIG 237 —Mineral production in the British Isles

The intensity of the industry has given to Lancashire eight times the population of Rhode Island, although its area is only eight per cent greater A son often succeeds to his father's place in the mill and the skill of the Lancashire operative may almost be said

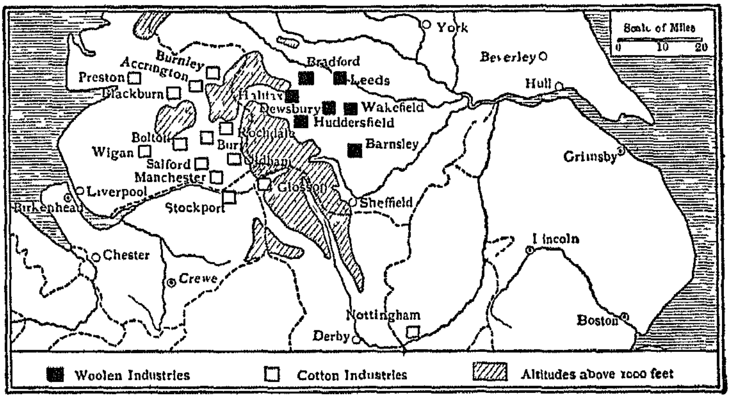


FIG 238 —Location of cotton and woolen industry in England

to be hereditary, with factory work and school dividing the years of youth

England sends fine cottons even into the best cotton manufacturing districts of the United States and of northwest Europe, the total British exports of cotton manufactures, $850,000,000

(1923), comparing favorably with the total foodstuffs exported from the United States, $1,050,000,000 (1922).

England has been unable to secure such leadership in the world's supply of woolens as has been the case with cottons, nor is the industry so important There is little difference in the amount of woolen goods produced in England, the United States, Germany, and France (Fig. 240) The explanation of this greater equality in wool than in cotton manufacture is to be found in the fact that wool manufacturing was a world-wide domestic industry before the factory system was developed The Industrial Revolution found wool an established industry and merely trans-

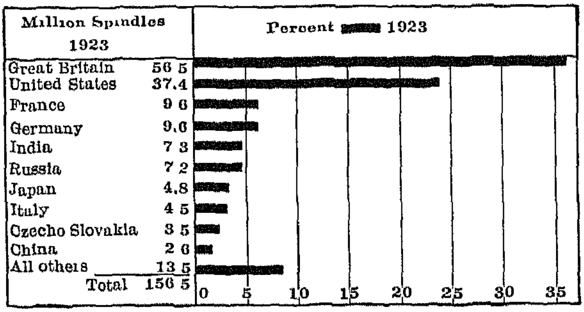


FIG 239.—Number of active cotton spinning spindles in the world. (International Cotton Bulletin.)

formed it. Wherever men made flour they made woolen cloth, and the adaptation of primitive water-powers to the hand loom was a small change, much smaller than learning how to use a new fiber such as cotton. Cotton manufacturing was thus a new business, resulting from what was in effect the discovery of cotton when Whitney's cotton gin made its production cheap This came after the textile machines were established in England. That country, being in much the best position to manufacture textiles in factories, seized the new raw material and built up a world's trade in cotton, while wool, an industry as old as history, was still being made upon hand looms in millions of farmhouses and in every textile village of Europe and America With the tenacity which comes of an early start and the hereditary knowledge

that lingers in families, wool manufacture has continued wherever, in the cooler parts of Europe and America, there is a population dense enough to develop any extensive manufacture England, however, leads in exports of wool manufactures The towns of Bradford, Leeds, Huddersfield in Yorkshire, just across a low mountain range from Lancashire, are known wherever fine woolen cloths are bought and sold

Linen. The manufacture of flax into linen is important in the United Kingdom. The north of Ireland (especially near Belfast), and the south of Scotland, which a century ago grew flax and manufactured it in hand looms, now are the centers of the world's finest factory-operated linen manufactures, employing 100,000

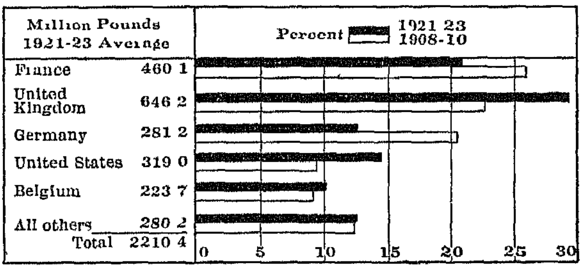


FIG 240 —World import of raw wool, three-year average

people and giving excellent illustrations of the influences of an early start as the basis for an industry Belfast gets its flax fiber from Belgium, from the small Baltic countries, and from Russia, which before the war was the leading producer, due to cheap labor

Silk. The silk industry in England is peculiarly unimportant for a nation so great in textile manufacture. England's early lead in cotton was duplicated by the similar early success of France (a producer of raw silk) in silk manufacture, which enabled the mills of that country to compete with those of England even in their own market Of late years there has been some manufacture of cheap silk goods in the cotton and wool districts of England, but the best silk goods used in England are imported, and the total number of silk employees is less than half as great as that in the United States.

Machinery and ships. The possession of the coal, iron, and machine-using industries has given England the basis to build up a great machinery export, especially of textile machinery which goes to all countries as they begin on the textile industry, but ship-building is the greatest iron manufacture in the United Kingdom With the cheapest iron in the world, produced immediately beside the sea, her advantages for this industry were even greater than for the cotton industry Her methods have also been the best The large shipyards in the British ship-building centers upon the River Clyde in west Scotland, the Tyne in northeast England, and the Irish harbor of Belfast give a good example of concentration The single city of Newcastle on Tyne built more shipping (240,000 tons) in 1922 than the whole United States (219,000 tons) in the same year The Glasgow district equals the Tyne, and the cities of Sunderland and Greenock each rival the United States in normal peace-time output Britain built nearly one-half the world's vessels in 1922 and possesses a vast merchant fleet containing nearly one-third the world's tonnage British-built ships are also flying almost every flag upon the sea, and on Jan 1, 1924, the British shipyards had under construction 1,400,000 tons of new vessels for 16 different nations

Shipping and trade. It is plain that British imports must fill many more ships than do the leading exports The imports of grain, meat (from Argentina and Australia), lumber, iron ore, cotton, and wool, are much more bulky than the cotton and woolen cloth, machinery, pottery, cutlery, and general manufactures that she sells Even her exported ships can carry a cargo away with them if a cargo can be found Fortunately there is coal to fill these empty ships as a kind of ballast cargo. Thus Britain becomes a greater coal exporter than all other nations combined. It goes by millions of tons to Brazil, Argentina, South Africa, the Mediterranean, and to the coalless countries nearer home such as France, Holland, Denmark, and Norway. This coal export is a fortunate factor for England. As the food vessel can earn money going out, it brings this food back more cheaply.

London the entrepôt. When she became the country with the greatest industry and the greatest commerce, Britain had, as a result, the best commercial connections She was the first country to develop a good network of steamer lines upon the moderniz-

ing of commerce after the peace of 1815 Lines went to the Continent and to the United States, and from the days of the old British East India Company there had been frequent connection with the East Indies London became the greatest trade center and the distributor of the products of Asia Having developed routes for her own trade, the route via London often became the easiest way for goods or people from one distant country to reach another. We see the same thing in the way people living near a town must often make a detour and go through it to get from one suburb to another Thus London, on the edge of the busiest ocean, and also on the edge of the busiest continent and also of the busiest country, became the greatest trade center or entrepôt in the world

But the importance of this intermediary or entrepôt trade must not be overestimated, for it has always been subsidiary to the commerce that is essentially national in its origin or destination This was true of London in 1865 when she was the undisputed world metropolis and it is true in greater degree in the present when her entrepôt supremacy is being shared by other cities

Other nations rise to commercial independence. When Germany, Denmark, France, Belgium, or the United States wanted small shipments of Indian, or oriental, or Italian goods, it was convenient and financially advantageous to get these goods in England, because Germany, Denmark, France, Belgium, and the United States had regular and frequent connections with England, and England had connections with the Orient After a century of multiplication of commerce, London is still the leader, and richer than ever, but other cities are also distributing the products of the East since they have developed direct connections of their own Half a dozen British ports have direct lines to the East. German lines go from Hamburg and Bremen, and French lines from Havre and Marseilles There are frequent and regular eastern sailings from Antwerp, Genoa, and Copenhagen. New York also has regular connection with the Orient, Australia, Cape of Good Hope, the coasts of South America, and the ports of the Mediterranean and the Baltic

Other cities become entrepôts. Before the World War Hamburg had in part succeeded London and Liverpool as the basis of foreign

goods supply for Scandinavia and the Baltic; but almost before Hamburg was secure in her new trade possession, lines of steamers were beginning to carry the products of America and the Orient direct to Newcastle, Stockholm, to Copenhagen and to the Russian ports. As Europe recovers from the World War these steamship lines and trade activities will be restored.

London as a capital and export center. As New York is the great center for the foreign trade and financial operations in the United States, so London buys and sells for the whole United Kingdom, and to some extent for many foreign countries. The London export house buys Manchester goods for shipment via

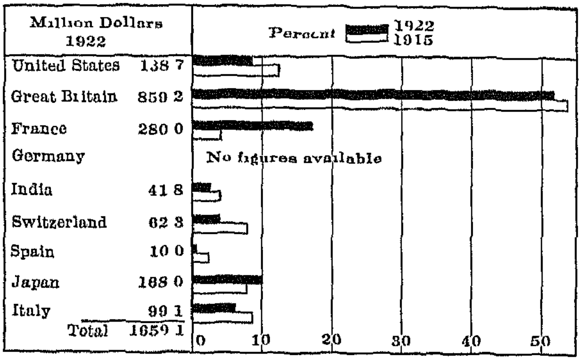


FIG 241.—Exports of cotton manufactures

Liverpool to customers in Bombay or Valparaiso. This might be called bargain center work, but there is another stage, the actual ownership.

Direct control of distant industries from the bargain center. The capitalists actually carry on industries and manage them and sell the product through the headquarters in the capitalistic center. The Standard Oil Company from its office in New York buys lands in Mexico or Oklahoma through salesmen in New York. It buys pipes from Pittsburgh companies with offices in New York. The Jarri paving-wood industry of western Australia is all managed in two or three buildings in London. London has thousands of companies doing business abroad, and, if one walks through the business districts and reads the signs upon the office buildings, he

can familiarize himself with geographical names in every continent, in almost every country or island with resources to develop and with inadequate capital. Britain had much capital for foreign investment when the United States, like every other country in both Americas, was a borrower. The World War impoverished England, enriched the United States and put her into the lending or foreign investing group.

It should be emphasized that this capitalistic development has but begun. A mere corner of the world, perhaps two million square miles or four per cent of the earth's land surface, has capital to spare, and all the vast remainder of the world must depend upon imported capital for the execution of any considerable enterprise, such, for example, as the building of a railroad. This is true of the entire continents of Asia, Africa, and South America, the East and West Indies, Australia, Central America, Mexico and west Canada. We still have some foreign capital invested in America, but since the war our wealth is so much greater than Europe's, that we not only finance ourselves but are sending capital into foreign lands, as Britain has done for many years. But many parts of our own country must borrow to finance a big enterprise. Throughout the nineteenth century the countries of northwestern Europe were the sole exporters of capital, with England far in the lead.

The income from all these investments, the earnings of the British ships that carry in every sea, come back to the English owners in goods. Thus England is able to import much more than she exports (see table of values of Food Imports).

Questions

1. Explain what industrial changes are causing the sheep flocks of Europe to decline.
2. Compare the United States and Europe as to proportion of arid land.
3. Why does Europe grow more potatoes than we do?
4. State and explain the difference in the way forests are cared for in the United States and in Europe.
5. Is it fair to compare the foreign trade of England, France, and Germany with that of the United States?
6. How did a climatic factor make England an exporter of wool, and mineral factors make her later an importer of wool?
7. How does the English climate favor athletic sports more than the climate of New York?

8 Show the relation between an early start and the linen and silk industries of the United Kingdom

9 Has Pittsburgh or Newcastle greater advantage for assembling raw materials for iron making?

10 Why does England's food supply make her anxious about her navy?

11 Why can the mountains of Scotland remain without forests while those of France cannot?

12 How does England's wealth enable her to import more than she exports?

13 Why is not the United States, the greatest coal producer, also the greatest coal exporter?

14 Where would the money come from to build a new railroad in New Mexico? Florida? Persia?

CHAPTER XXIV

FRANCE AND BELGIUM

Climate. Beautiful France, as the inhabitants like to call it, has the oceanic climate of Britain, so has Belgium. The boundary between France and Belgium is as artificial as that between Indiana and Illinois. French is spoken in both countries and the two really comprise one industrial district. France finds its American counterpart in central and northern California. It reaches from the sugar-beet zone in the north to the olive, prune, and trucking territory of the Mediterranean coast. The country is good from end to end (Fig. 247).

Agriculture. The coal supplies are very meager and manufactures have as a result a minor place. France is still primarily an agricultural country. The French landowner is the strength of the nation. Each peasant farmer owns his few well-tilled acres, instead of renting them as the English farmer does. Also unlike England, France grows nearly enough foodstuffs to feed her own population. Only 18 of her 39 million inhabitants live under urban conditions, while 21 million are classed as agricultural. The people of France are energetic, thrifty, and capitalistic, investing in enterprises in many lands. Her mountains are well and carefully forested to stop erosion. Her sandy marshes along the Bay of Biscay have been converted into lucrative pine forests that are practically farms for turpentine and wood. When mature the trees are systematically bled to death, giving the maximum of both turpentine and timber.

That France is primarily an agricultural country is shown by the fact that two of her great exports are from the farm—dairy products and wine. In the north the intensity of agriculture and density of population resemble those of Belgium. In other parts her agriculture is moderately intensive. With only one-sixth as much tillable land as the United States, the wheat crop is nearly half that of the United States, and the acre yield is one-third

greater Yet in parts of rural France the methods are surprisingly unscientific and archaic, much less efficient than that of Germany which has improved about 50 per cent in acreage yield between 1870 and 1914, while that of France stood still France has large possibilities of increased production French farms average 20 acres each, and those of the United States average 150 acres

Four times as many potatoes per person are raised as in the United States Northern France is the center of an intensive

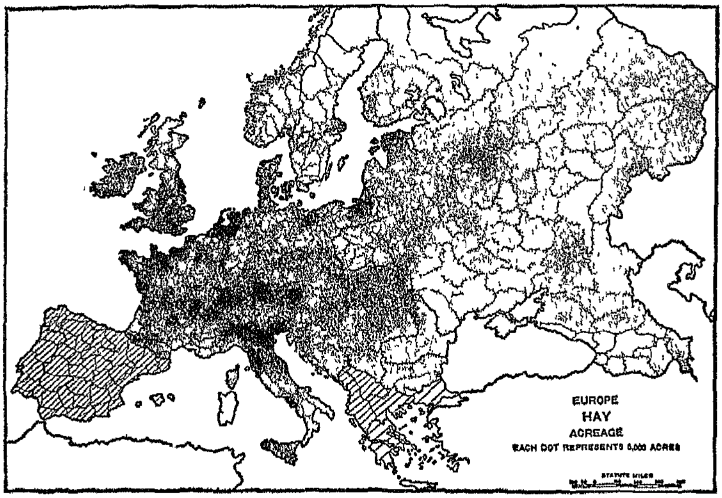


FIG. 242.—Western and Central Europe has abundant rainfall and rich pastures for livestock (Finch and Baker.)

sugar-beet region As in England, barley and oats are grown and hay is important, because of the large animal industry. The Percheron horse, native in the department de Perche, the finest of the heavy draft horses, is bred in large numbers in the north of France. Sheep and cattle are extensively raised on the damp and hilly and grass-rich western peninsula, called Brittany In the production and export of butter and special brands of cheese France rivals Holland and Switzerland. (See Fig 242)

Wine-growing is the most characteristic agricultural industry of France (Fig. 243), and before the World War the crop was

worth moie than half as much as the wheat ciop Fiance, Spain, and Italy produce five-sixths of the woild's wine, a peculiar dominance of an agricultural industiy by the old and populous countries Wheat-giowing has shifted quickly to far fiontiers Not so with wine-making This industiy is haid to move. In the fiist place it is an intensive industiy requiiing a dense population, which frontiers rarely have Like a garden crop it iequires much labor to

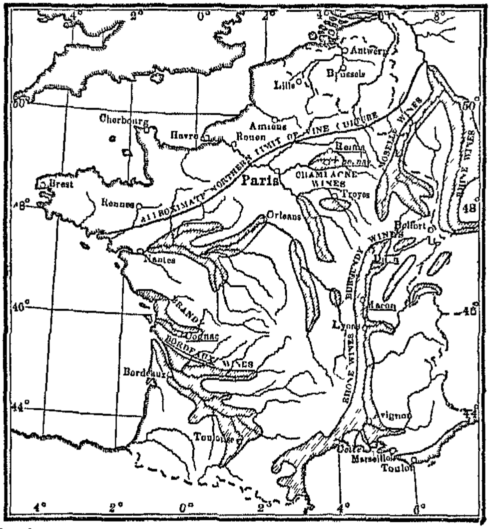


FIG 243 —Chief wine-producing aieas of France Names of wine and brandy centers underscored (After Brigham)

produce the grapes The yield is great, in France about 200 gallons of wine per acie. In the second place, expensive appliances and much labor are required for the fermentation of the juice into good wine, and great skill is required to get the desiied flavors in the product Lastly, wines are sold by the name of the country or place producing them, as Burgundy, Madeira, Champagne, etc , and a long time is required to establish a reputation Few crops are so affected by the soil, the moisture, and the temperature as is the grape, and particular vaiieties of grapes are often limited to narrow localities. Thus France remains the leader of wine-producing

countries, and the good esteem of French wines, makes them, after textiles, the chief export of the country The *Phylloxera*, a tiny insect of the aphis family, gets upon the roots of the grapevine and sucks the juices from them until the vine is killed This pest nearly ruined the European wine industry about 1885. The only thing which prevented the practical extermination of grape and wine growing throughout the Old World, was the fact that in America, the home of the *Phylloxera*, there were varieties of grape immune to its attacks These were imported to Europe, set out by millions in the vineyards which the *Phylloxera* had devastated, and tops of the European varieties were grafted upon these tough American roots, making a composite plant with American root to resist the destroying insect, and a European top to produce the desired wine grape

The French also import much Italian and Spanish wine which they mix with native wines and flavor, label, and export as French wines They even import millions of pounds per year of the dried currants (grapes) from Greece, which are manufactured into wine for export French wine production amounted to 1,835 million gallons in 1922 as compared to 1,586 million gallons in 1914

The agriculture of Belgium. The chief difference between France and Belgium is the greater density of Belgium population—over one person to the acre—and the greater intensity of agriculture. This population is about twenty times as dense as that of the United States, and the country produces per square mile sixty times as many potatoes as does the United States. Other leading crops are oats, rye, and wheat, sugar beets and beets for animal forage. The garden farmer of north France and Belgium keeps hares and rabbits to which he feeds the weeds that are pulled from his crops. Hares have the advantage of being able to thrive in closer confinement than poultry, and they will feed on a very wide range of vegetable food They are quite generally kept, both for their flesh and their skins and are exported to England by the hundreds of tons The skins of these animals are an important material for the manufacturing of hats

All this intensity of agriculture means large product per *acre*, not per man (Fig 245) Belgium averages 37 bushels of wheat per acre while the United States averages less than 15, but the

American *farmer* produces more per man than the Belgian farmer. It is estimated that the Belgian farmer produced before the war on the average $508 worth of produce per year, and the American farmer $1,004 worth. If the United States should suddenly produce as much per acre as Belgium it would cause the most paralyzing panic ever seen. There would be no market for the produce, as there is now no market for the water of the roadside spring, which would make its owners rich if beside

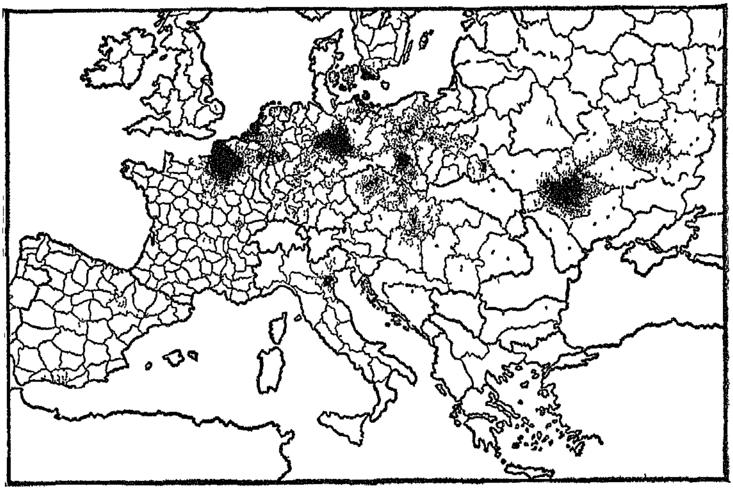


FIG. 244—Northern France, Belgium and Germany have important sugar beet regions (Finch and Baker)

a Sahara caravan route. Belgium, while not a farming country, has a larger percentage of her population engaged in agriculture than we have in the United States.

Manufactures. The best coal field in France and Belgium lies on both sides of the boundary of these two countries, as does the greatest manufacturing district Coal production is not large and both countries lack sufficient fuel for manufacturing purposes. The return of Lorraine to France since the war has given her a plentiful supply of iron ore, but coke for smelting must be imported. The industries of the Belgian are rather heavier then those of the French side of the boundary, iron and cement

being more important. Much fine glass is made in this region, as are also the French porcelains known as Sèvres and Limoges.

Oils. Marseilles has long been a center for the collection of the

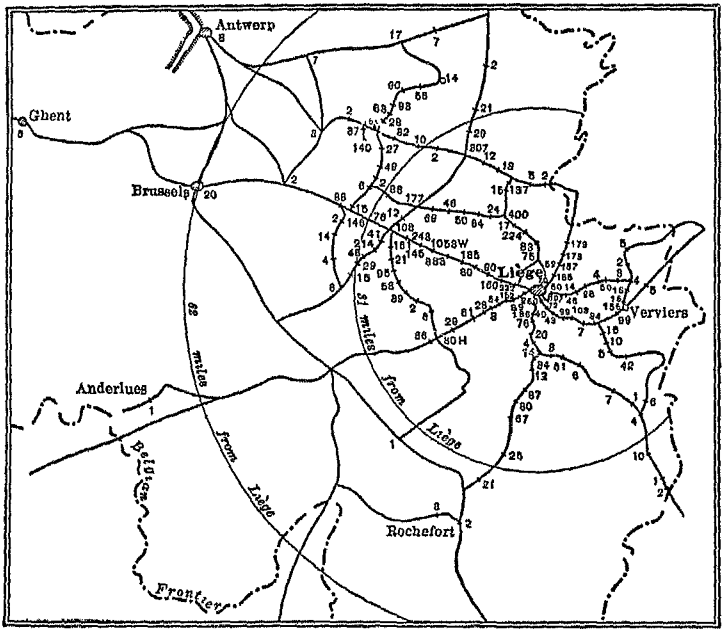


Fig. 245.—Distribution of city workers of Liège, to village homes Figures represent number going from each station to Liège, June 1–5, 1906 Small agriculture is added to factory wages By trades miners 1,832, factory men 2,871, building trades 1,440, unskilled 1,493, dressmakers and milliners 360, apprentices 242, other trades 1,167, railway workmen 520, total 9,925, of whom 5,830 went daily and 4,095 weekly (From "Land and Labor" by B S Rowntree.) Belgium is ahead of any other western nation in the scientific utilization of her resources. Her factory workers live upon the land to a degree unknown elsewhere With his plot of ground there is room for production by the aid of women and children, old persons, and the spare time of the artisan himself This garden product, the poultry, hares, and possibly the cows are great additions to a low wage and they conduce to the intensity of culture that gives large return per unit of land.

olive oil that is produced on all the shores of the Mediterranean As oil is the chief raw material for soap, Marseilles has become a great soap-making center and a great market for many kinds

of oils Cotton-seed oil, mainly imported from the United States, cocoanut oil and peanut oil from Asia and the African colonies have become rivals of olive oil, for both food and soap. The list of imported oil materials (see Appendix) shows the extent

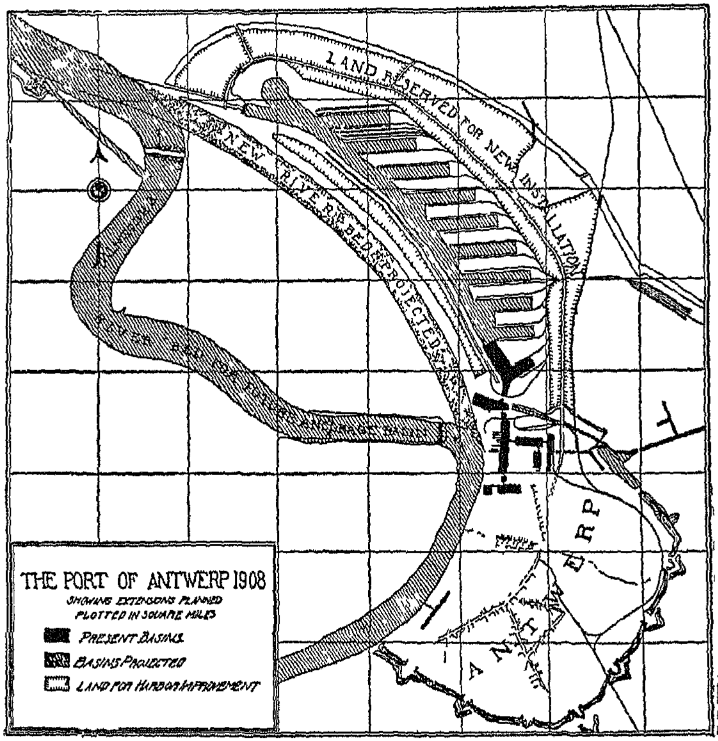


FIG 246 —Antwerp has outgrown the fortifications put up as a defence against Napoleon III and before the war had port plans that are probably unrivalled for comprehensive system. America can show nothing like it (After J Paul Goode)

and phenomenal growth of the industry at Marseilles. The manufacture of fine toilet soaps is a leading industry

Textiles. Silk spinning and weaving is a very old industry in France. Italian silk workers, who were brought from Milan in 1515, introduced the mulberry and the silkworm into the valley

of the Rhone, and established silk manufacturing at Lyons The weaving of the finished goods has so far outstripped the production of the material that France now has a heavy import of raw silk from Japan, China, and Italy Lyons is still the leading silk center of Europe and its looms, which were noted during the nineteenth century for the richness and strength of their fabrics, are now equally as famous for producing new and exquisite weaves to suit the ever-changing whims of fashion.

Northeastern France is nearly as great a cotton-spinning region as the Rhone Valley for silk making Lille and Rouen are the leading cotton-mill cities The cotton cloth industry, which had been developed to a very high degree of perfection before the war, was greatly damaged when the Germans overran this section of France and occupied it for several years Woolen goods are made in this same region, centering at Amiens, Rheims, and Roubaix Both the woolen and the cotton industry will be some years recovering from the effects of the war

Paris, famous as an art center, and visited by thousands of moneyed people from all over the globe, has developed a type of manufacture which utilizes both the artistic qualities of the French, and its own fame as the world's fashion capital. In the hands of Paris dressmakers and costumers whose names are known to the wealthy in every land, the silks and fine linens from the French looms are draped into ladies' gowns, new, beautiful, and costly The cunning touch of artist-milliners evolve Paris hats, supposedly more stylish and desirable than English or American hats. Beautifully woven tapestries, delicate perfumes, finely-wrought jewelry, and many other articles whose main value lies in skill of workmanship, have all helped to make the magic word "Paris" on an article of luxury a guarantee of its excellence and style In 1922 France's three most valuable exports in order were silk fabrics, women's clothing, and cotton fabrics. Her export trade of the future is likely to remain those highly-skilled manufactures in which she has more or less of a monopoly advantage.

Belgium, a trader nation. While France raises nearly all of her own foodstuffs and to that extent is independent of other countries, Belgium must import three-fourths of her food, paying for it by exports of manufactured goods Surrounded by France,

Holland, and Germany, Belgium is at the cross-roads of Europe. Even before the war Belgium was finding it profitable to depend more and more on her foreign trade and less on agriculture. With 1,000 miles of good waterways, she is the natural gateway for the commerce of western Europe, much of which passes through

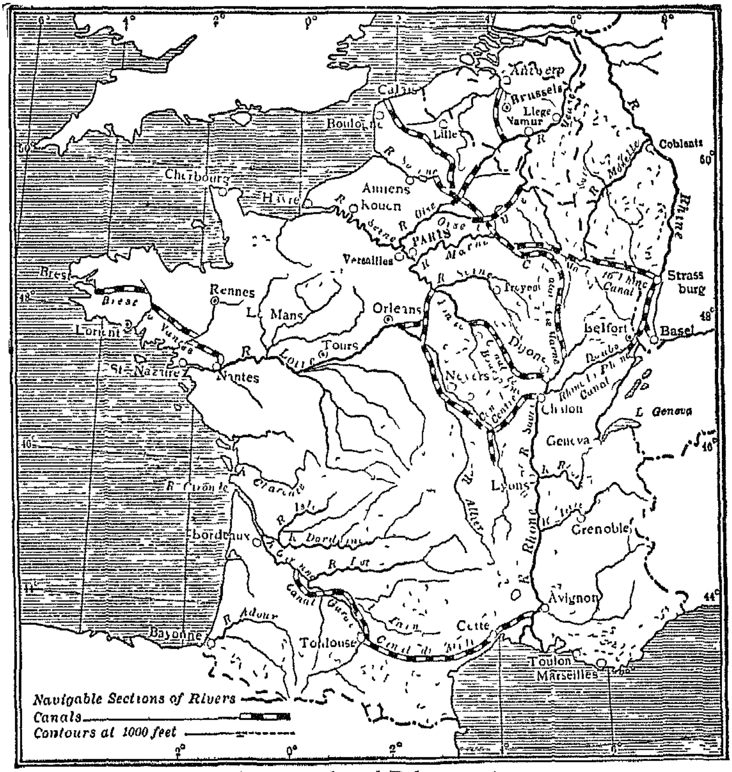


FIG 247 —French and Belgian waterways

Antwerp, which now ranks third among the ports of the world. (Fig 247). Brussels resembles Paris in its manufacture and trade One of the famous exports to which it has given a name, is that of Brussels lace, hand-made by the peasant women in the intervals of farm and household labor, and sold in Brussels.

Questions

1. How have the resources of France left her behind England as a manufacturing country?

2. How does the foreign trade of France indicate her agricultural importance?

3. Why does the wine industry not follow the wheat industry to suitable new countries?

4. Why does Belgium have a larger percentage of farmers than the United States?

5. How may it be said that Paris goods show a quality of the French people?

6. How does the climate of southern France make Marseilles an importer of dried cocoanuts?

7. State two reasons why it would be undesirable for the lands of the United States to produce as much as those of Belgium.

8. Why can Paris sell finer and more expensive goods than any other city?

9. Explain why the differences in foreign trade of France and England made hard feeling between the two countries in 1923 over the question of compelling Germany to pay war indemnity.

CHAPTER XXV

GERMANY

Germany is the home of all of the great body of German-speaking people save the Austrians and some of the Swiss. During the Middle Ages these people were divided among several hundred little states. In 1871 there were 27 states including kingdoms, duchies, grand duchies, principalities, and free cities such as Hamburg. Prussia was much the largest, and most powerful state. In 1871 the 27 states formed an Empire much as our states form the United States.

After the World War, the land of the French-speaking people was ceded to France, of the Danish-speaking people to Denmark, and of the Polish-speaking people to Poland.

Germany's collapse was the failure of an attempt to rule the world and the failure of the world's greatest attempt to make a nation economically independent. The World War taught millions that no nation is independent or can be. This, of course, has long been plain to anyone who closely examined the conditions under which modern communities lived, but the war ground the fact into the minds of whole nations.

The Germany of 1914 was really a marvel in the success that had rewarded long, careful, and scientific labor to make a nation as nearly independent as possible on the rather slim basis of Germany's natural resources. To see that Germany is a poor country in comparison with the United States, compare the two countries in area, population per square mile, variety and area of staple crops, variety, production, and resources of important minerals.

The Germany of the future is difficult to predict with certainty, but there are good reasons to expect that most of her industries will resume, even though some of them at present (1924) are below the level of 1914. The total area cultivated in Germany in 1923 was about three million acres less than in 1913, in the same territory.

The World War destroyed no equipment in Germany and a vast amount of manufacturing equipment was made on account of the war

The meager resources of Germany. Germany lies wholly within the zone having sufficient rainfall for agriculture The northern half of the area is a coastal plain, much of it like parts of our Atlantic coastal plain, with sandy soil of low fertility, but the German plain has been made into fields of potatoes and rye or well kept forest. In central and southern Germany are the Harz and other

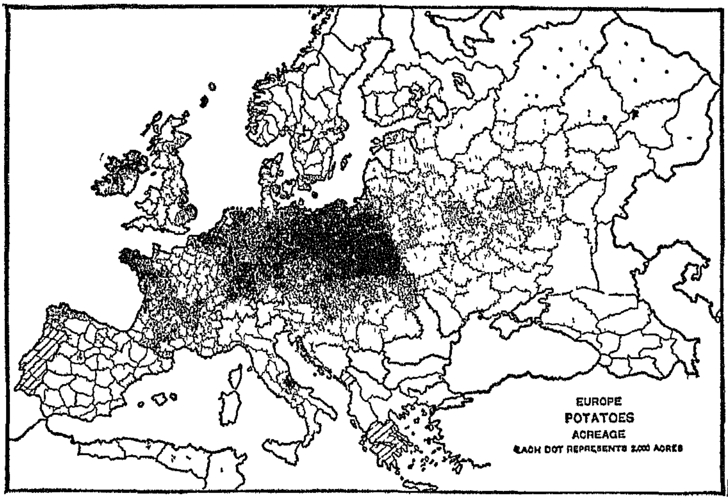


FIG 248 —Germany's leadership in the world of potatoes is plain (Finch and Baker)

mountains, low and well forested There is very little mineral output aside from coal, iron, potash, salt, cement, and building stone Germany is not naturally rich in soil and minerals like the United States, but like England has enough for the present. Both together are poor in comparison to the United States.

Scientific development of materials and men. The conspicuous thing about the industrial life of Germany has not been her resources but their scientific development. Never in the history of the world has a nation so systematically developed all of its resources, human and material. Why was this? It seems plain that it happened because of the firm conviction in the minds of the

German leaders that she needed to be a strong military nation. Located in an open plain in the center of Europe, she has been trampled by armies at frequent intervals from the time of the roaming Goths, Vandals, and Huns to the 17th and 18th centuries when Louis XIV of France, Gustavius Adolphus, the Swede, and the armies of Russia have in turn ravaged her territory. The final act in this series of pillagings because of her open location was the Napoleonic Wars, during which she was crushed to the dust, humili-

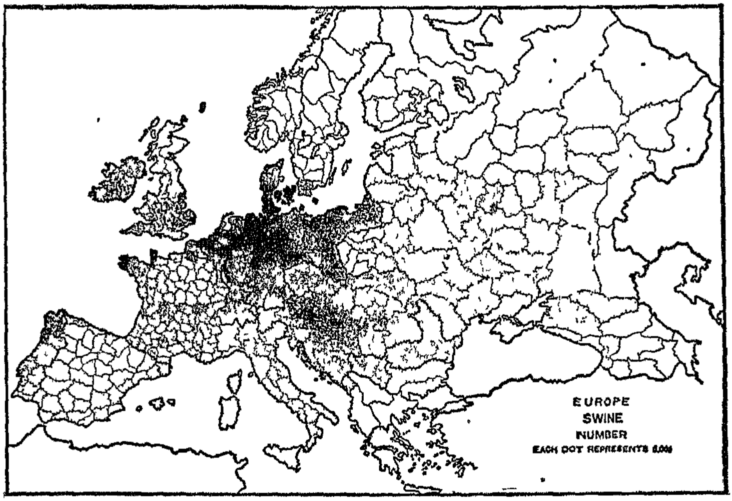


FIG 249 —The swine region closely coincides with potatoes in Europe, corn in America (Finch and Baker)

ated in the extreme, and from which she emerged with the natural conviction that she must be strong enough to defeat her neighbors. To be strong in the military sense, Germany did five things.

1. Educated her people to make them efficient in industry and the army.

2. Promoted social legislation to keep the people healthy and strong.

3 and 4. Promoted agriculture and manufacture by tariffs, bounties, and scientific investigation, to give herself varied industries.

5. Promoted the development of science because it stimulates industry and the development of war equipment

She promoted education to the point where no other large nation had such a high percentage of its people educated so thoroughly.

As a part of her educational campaign, she promoted science, the branches of learning that make industry, rather than literature and languages, the branches of education that make culture or the mere, but really great, pleasure of being learned and knowing things At a time when the colleges and universities of England and America taught almost nothing but ancient languages, mathematics, and a little history, the German universities were turning out doctors of philosophy in physics, chemistry, geology, botany, zoology, and geography. No other country accorded such honors and rewards to the man who had made a real achievement in science, and it may safely be predicted that any nation will ultimately lead in proportion as it learns to honor and reward, and therefore urge onward, people who render it real service of a constructive character which improves the condition of the masses of its people

Despite German attention to science, it has been repeatedly pointed out that they have not been so highly original as some nations where the individuals were left more free Compulsory education is not necessarily the way to genius but it certainly increases the efficiency of mediocrity. Few really great inventions have come from Germany. An American, Morse, invented the telegraph. An American, Bell, invented the telephone Americans, Langley and the Wrights, invented the flying machine An American, Simon Lake, invented the submarine. Germany has no counterpart of Edison, the multitudinous inventor, or of Ford, the organizer. Darwin, an Englishman, put the sciences of botany and zoology at the large service of man. But it was the Germans, with their thorough system of school and discipline who first taught a whole people how to utilize these things This gave her industries a more scientific bent than those of any other country She thus came naturally by her position of leadership in chemical manufacture [1] such as the coal-tar dyes and other coal products. By skill, care, and work German forests became models of productivity, and Germany rivaled France and Switzerland for leadership in the science of forestry, 25 per cent of her area was in forests

[1] The cessation of German trade caused by the war of 1914 brought great disturbance to the American supplies of dyestuffs, drugs, photographic supplies, potash, and other chemicals.

By skill, Germany's meager supply of brown coal is made usable by being compressed into briquettes Much of it was made into coke by processes that left the gas and tar and gave the raw material for the dye industry The Diesel engine that uses crude petroleum in place of gasoline is a German university product So is the Zeiss glass that made nearly all the high-class lenses in the world before we were compelled to learn how to make it in this country during the war One of the amazing results of the war was the way Ameri-

FIG 250 —In densely peopled Saxony the peasant women and the dog are draft animals Factory labor is abundant

can scientists invented things and discovered things when they were given the chance, the equipment, and the time

Germany's scientific agriculture. On her area, which before the war was considerably smaller than that of Texas Germany had twenty-six more experiment stations than were to be found in the whole United States (not counting substations) The utilization of the beet and the potato are triumphs of great national importance. Her rough land is most scientifically forested. Her swamps are made into fish ponds where carp and trout are fed as we feed poultry in a yard. There are many fish growers' associations in the

empire and the total area of fish ponds approaches 200,000 acres. In Saxony they cover one-half of one per cent of the area (Compare with the three per cent under cultivation in Cuba or seven per cent in California) The dog and the cow are made to work as draft animals (Fig 250), and the growth of song birds, exported by the hundreds of thousands by factory artisans of the Harz Mountains shows an extreme development of the animal industries

Grain. In German agriculture, wheat and barley (see chapter on Cereals) are produced in nearly equal amounts, but owing to the poor sandy soil of her northern plain she grows three times as much rye as wheat Germany formerly had one-fourth, and Russia, into which the same plains extend, has had one-half of the world's rye

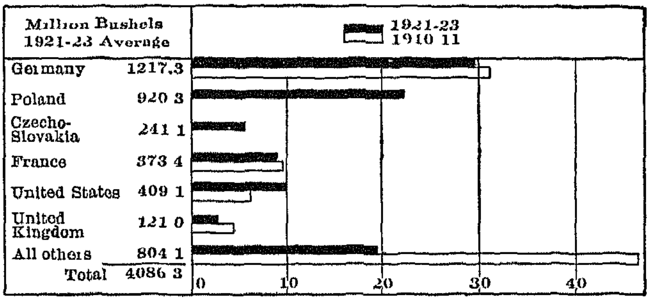


FIG. 251.—World's potato production, three-year average.

crop but both have fallen off since the war. The peasants and factory workers of rye-growing countries eat the most of it in the form of black bread, which after all, is nearly as nourishing as wheat bread But these people frequently substitute the superior and more highly esteemed wheat bread for rye bread, when they become able to buy wheat The oat is also an important grain, with barley it partly fills the great forage gap caused by the absence of corn, for which the climate is too cold.

The potato is more important in Germany than any grain (Fig. 251). The failure of the potato crop would have brought on a German collapse in any year of the war Germany has five times as many potatoes per capita as the United States, but they eat only a fraction of the crop. The farm animals consume a large proportion. Potatoes are used for starch-making, for alcohol (a

substitute for kerosene) and even before the war half a million tons were dried in more than 400 potato-drying factories. The product was used in chemical manufacture, in thickening soups, in bread and pastry making, as a substitute for corn meal, but chiefly for forage. These potato manufactures give stability to potato prices. There was a price fluctuation of 27 cents per bushel in Berlin in five years, while Chicago had a fluctuation of $1 34, with the result that the American farmer grows potatoes in the continual dread of a glutted market which comes every two or three years The stability of price afforded by these permanent outlets enabled the Germans to grow potatoes in great quantities. During the war the drying of potatoes

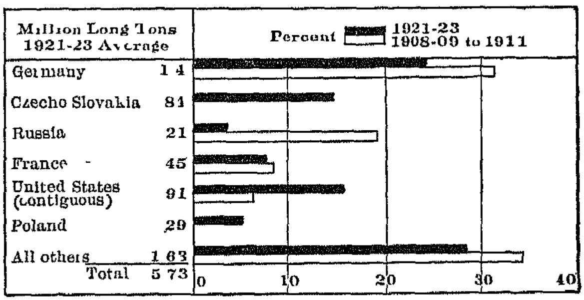


FIG 252 —World production of beet sugar, three-year average

and other vegetables increased enormously in Germany and was one of the things that enabled her to hold out as long as she did.

The sugar beet. As the potato and the sugar beet leave the soil in splendid condition for a crop of winter grain, their cultivation tends to increase the grain yield Because of this fact, it is probably true that Germany or any other country can grow more grain on a given area after adding potatoes and beets to the crop series than before. It is largely due to German selection that the beet has been improved to its high sugar content Germany has a splendid beet climate (Fig 252) and exported sugar for several decades before the World War

The by-products of the beet field serve greatly to enhance the usefulness of this crop in the intensive agriculture of a populous country. The leaves and tops of the beets were worth in Germany, for cattle food, $4 50 to $5.75 per acre, before the war, which makes

an interesting comparison with the $9 37 which was the farm value of the average acre of wheat in the United States at about the same time The pulp from which the sugar has been extracted is taken back by the farmers and fed to cattle, and the average value of this in Germany was $10 40 per acre, whereas the average American hay crop was worth on the American farm $14 41 per acre, a figure that was less than the value of combined pulp and leaves of the German beet crop. It is therefore plain that beet growing plays an important part in the cattle-keeping agriculture of the small farms of north Europe

German sugar production. The map of beet production in Europe (see Fig 244) shows that while its growth is scattered through central Europe from northwestern Spain to Moscow, there are four centers of importance The greatest is in central Germany, near Magdeburg, where beets occupy from one-tenth to one-seventh of all the cultivated land Here the beet fields spread in great expanses over the level, perfectly tilled plains and while the peasant children pull the weeds, their mother may be seen plowing the beets, using at times the family cow for a draft animal The most intense of all the sugar districts is in Bohemia, a part of Czecho-Slovakia, where beets are grown as they are in Germany

Poland is also a land of rye, oats, barley, potatoes, and beets.

Wine growing. Germany has some fine vineyards and wine, but it is so near the northern limit of the grape belt that the desired heat and sunshine are obtained by planting the vineyards on the southward sloping hillsides (Fig. 253) In this way they are protected from the north winds and exposed, by the inclination, to the nearly perpendicular rays of the sun, and often get in addition the reflected sunshine from water surface as of the Rhine, the Moselle, and the Swiss lakes.

Manufacture and food supply. Germany has stimulated manufactures more than any other nation, using tariffs, bounties, favorable rates on state railways, and by developing the best system of inland waterways in the world. The straightening of the crooked lower Rhine, the deepening of the rocky upper Rhine were great works Other rivers were improved and many canals connected them

To these material aids to industry she added human skill as improved by a highly differentiated, technical education. No

entered the class of nations dependent on imported food At the outbreak of the war, the annual importation of agricultural products and foodstuffs into Germany amounted to $1,700,000,000 and the exports of goods of this class were worth about $400,000,000

With a population of 60,000,000, the Germans have but 16,000,000 cattle on the farms, whereas the United States, with about 110,000,000 population, has 66,000,000 We have 37,000,000 sheep, and the Germans 5,500,000, the American farmers

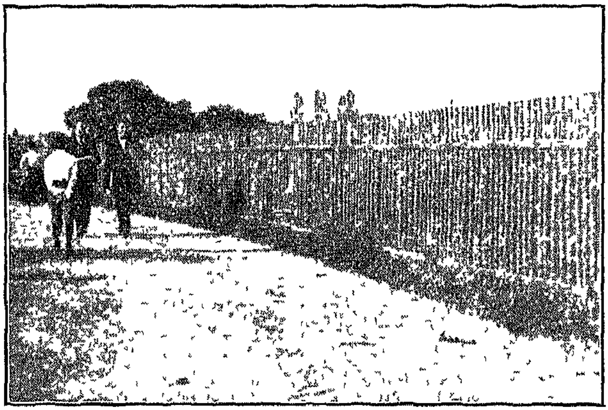


FIG 254 —German fence made of forest thinnings Uprights are first thinning 1 ½–2 ½ inches in diameter, round Cross pieces are second thinning split Posts are larger round pieces No saw dust or slab waste The forest was planted with trees about as far apart as hills of corn in American fields

own 63,000,000 swine, and there are less than 15,000,000 in Germany

The growing scarcity of animal food is being met by the Germans in a very effective and scientific way. Butter and cheese and meat are but digestible fat and protein (see table of food analysis, appendix) Many vegetable oils furnish very similar fat and there are many cheaper proteins than those in cheese and meat The oil of the olive has been an age-long peer of butter Cotton-seed oil is now used as a substitute for olive oil, for butter, and for pork fat, and its use has spread so rapidly that in 15 years its price increased fourfold despite a doubled

output. Even more promising rivals for dairy products are found in the oily cocoanut and the nutritious peanut, and the oil of the soy bean, all of which were used in Germany during the war and sprung into great commercial importance during the war scarcity

Nearly half of the meat of the cocoanut is fat or oil, and the nut has the quality, unusual among oily vegetables, of keeping for many months without becoming rancid The pre-war rise in

FIG 255 —Potato harvest in Germany Even before the war the German peasant woman worked in the fields almost as much as the man (Photo by Louis P Robinson)

the price of animal products had caused increased attention to be given to the cocoanut as a source of food fat Some chemist worked another atom of hydrogen into cocoanut oil This changed a strong smelling liquid into a firm tallow-like white solid, and the butter substitution process began apace In a short time nice looking butter, made yellow with egg yolk, and flavored with a little cream, appeared on the market It spread through Europe like a new style in clothes Boatloads of copra went up the Elbe to central Europe, and oil mills arose in every port. The cutting off of the supply of vegetable fats, along with

the lard and bacon of America, was the most painful blow given by the war to the German stomach. The war showed that fat food is more important than dietitians had thought.

In Austria, Holland, and England, and Scandinavia, the same substitution of vegetable for animal fat is taking place The output of European margarine factories using cocoanut oil as a base was put at 16 million pounds per week in 1913, an amount that then exceeded the total European import of butter The war reduced the supply of butter while it multiplied the production of vegetable fats The supply of cocoanuts promises to be almost unlimited because of the great extent of unused land on nearly all tropic continents and islands suited to the cocoanut palm, and the ease of producing a product that falls from the tree and lies for weeks embedded in its thick cushion of husk waiting to be picked up Peanuts and soy beans are no less promising in their possibilities.

If Germany can restore her export trade she can of course import these foreign food supplies and again be well fed.

Iron and steel. Germany is second only to the United States in iron and steel making, having passed England in output about the end of the nineteenth century, but the chief German iron district is economically part of a region which extends through northern France, Belgium, and the lower Rhine valley, and especially of its branch, the historic Ruhr, where local ores, coal, and the dense population give the necessary conditions for modern iron making. The navigable Rhine, with cheap transportation by barge, makes possible the import of Swedish and Spanish ores through Rotterdam, Amsterdam, and via canal from Antwerp, and the export of finished product through these same ports, whose steamship lines take the finished products at cheap rates to all the world The supplies of ore in nearby Lorraine are very great. The town of Essen, on the navigable Ruhr, a river reaching the Rhine below Cologne, is the center of the world-famous German iron industry owned by the Krupps

Germany has not exceeded Great Britain as an iron maker because of superior advantages. Germany's natural advantages are slightly inferior, but government aid, science, and energy, and a large population have fostered the industry

The growth of the German iron industry has been amazing. For

the world, there was a threefold increase in pig iron from 25 to 76 million tons between 1891 and 1913. In 1890 the output in million tons was: United States, 9, United Kingdom, 7.8, Germany, 4.5; in 1913, United States, 31, Germany, 19, while that of the United Kingdom was less than in 1900. In 1922 the figures were: United States, 28, Germany, 6.6, United Kingdom, 4.9. It is hard to predict what will happen to the German iron industry in the post-war adjustments, but these base facts should be kept in mind. The Rhine Valley has the plants, the workers and the industrial organization. In French Lorraine are the ore mines from which much of the ore was secured before 1918. The Rhine is also open to import ore from elsewhere. It is reasonable to expect continued iron making.

Other manufactures. The German textile industry also advanced rapidly before the war, the linens of Westphalia being especially famed. For chemical manufacture Germany has had the great advantage of the world monopoly of potash salts from the mines of Stassfurt near the Elbe River. During the World War the potash shortage of the Allied world was such that the prices rose from $40.00 to $600.00 per ton. Many chemical works are near the German potash beds. Germany is also a leading maker of fine papers and fine leathers.

In Germany, as in Holland, Belgium, and France, we see in the leather industry an interesting adjustment to the density of population. The scarcity of forests long ago caused the establishment of willow plantations so trimmed as to grow long slender twigs for weaving the baskets that replace the boxes and barrels (made of good saw logs) used in this country for the shipment of agricultural and manufactured products. These same basket willows yield a bark suitable for tanning leather especially adapted for glove making. The dense population of Germany, France, and Belgium gives the labor supply to turn these good leathers into a large glove output. Germany also makes fine glass and has long been an important exporter of porcelain. In her great export of toys we see a combination of cheap labor, skill, and the domestic instinct so strong in the Germans. At the present time, she finds that Japan is copying her toys and porcelain and supplying many countries formerly supplied by Germany. In considering Germany's future, it should be remembered that her

location in the center of Europe is the best there is for the development of a great trade. Undeveloped Russia is to her what the central and western states are to our own eastern states.

The war. The transfer of Lorraine to France leaves France in possession of the ore iron that Germany had owned. But Germany had been using ore from French Lorraine for many years, and the German iron industry should be fed by the same mines and quarries that fed it before the war. The transfer of the Saar coal field from Germany to France (for a time) will probably make little permanent change in industry. Industry must have labor and the population of France is not increasing very much while that of Germany is increasing.

Undoubtedly, the case of Germany is the strongest argument that can be advanced for the formation of some kind of international organization that shall remove even from Germany the fear of war, the need of war, or the possibility of war.

Questions

1. How have Germany's position and topography caused her to have a large army? And a large trade?
2. How has her manufacturing development aided in making a strong army?
3. Why is the price of potatoes more stable in Germany than in the United States? What is the effect of this on agriculture?
4. How is Germany meeting the high price of butter?
5. How has German esteem of scientific attainment enabled her to win some of England's foreign trade?
6. How does the Rhine serve the iron industry?
7. How does sandy soil cause the Germans to have black bread?
8. Name three ways in which German schools have made her army more effective? Her industry?

CHAPTER XXVI

SWITZERLAND

Scenery as a resource. Switzerland is an example of prosperity in spite of poverty of resources. There are nearly four million people in a territory one-third the size of Pennsylvania, with no coal, no workable mineral save salt and stone, 28 per cent of the surface covered with non-productive Alps, and 29 per cent so rough as to be fit only for forests, which by law are kept intact. Scenery, magnificent scenery, is the richest resource, and the tourist is the greatest crop. No single industry brings so much money into the country as does the foreign traveler. Right in the center of western Europe, and very accessible from America, Switzerland is the world's greatest playground. The tourist business is a national asset of such importance that when four years of war cut off a large part of the tourist trade, Switzerland's buying power was greatly lessened. Railroads and good highways make these mountains more visible than any other mountains on earth. A multitude of footpaths take you still farther, and expert guides are at the service of those who wish to risk their necks on glaciers, snow fields, and pinnacles of bare rock.

Forestry. The Swiss utilize their meager resources to the full. The land is very evenly divided among the small proprietors, of whom there is one to every nine of the population, an unusually high proportion. Some of the Swiss woodlands were carefully forested before Columbus set sail, and in the year 1910, 20 million trees were planted. The export of wood carvings along with piles for the docks in Dutch harbors, is an example of full utilization of raw material.

Farming. The chief field crops are potatoes, wheat, and oats. Most of the bread and meat is imported, but Switzerland is able to supply herself with potatoes and sometimes even suffers from their overproduction. As further evidence of intensive agriculture, she has an astonishing proportion (18 per cent) of her cul-

tivated area in fruits Grapes for wine-making grow in the warm valleys and on the southern slopes of the Alps.

Dairying. Dairying is another sign of full use of resources, also of adjustment to a rather damp and rainy climate which makes good pastures The Swiss have an interesting and unique dairy industry Relatively large areas of land upon the high mountains, above the timber line, habitable only in summer, produce an abundance of rich grass as the melting snow recedes and lets the sun shine upon the saturated earth The villagers of the valleys take their herds of cows and milk goats to the higher pastures in summer, and because of the distance, stay with them through the whole season, spending the nights in little huts that have been built for the purpose. At intervals, members of their families bring up the necessary supplies and take away the accumulations of cheese and butter which the herds and herders have produced On the lower slopes of the Alps the water from snow field and glacier is often conducted out over the fields to fertilize and irrigate the grass for winter hay As a result of this careful industry, Switzerland is an exporter of condensed milk and of good cheese, Gruyère being one of the best-known brands. Milk is also a large factor in the manufacture of milk-chocolate, in which Switzerland (like Holland) is important, sending abroad annually about three-fourths of the total products, but the dairying industry has suffered from the impaired buying power of Europe As some of the pastures are too rocky and steep for cows to climb, the Swiss have developed a very efficient breed of milk goats—animals that are, in proportion to their size and food consumption, superior to cows as milk producers

Manufactures. For manufacturing Switzerland is blessed with water-power, and in hydraulic engineering she stands high Swiss engineers designed the power plants at Niagara Falls She also stands high in the skill of her people who make fine goods. Her leading exports are fine cotton and silk fabrics, embroideries, ribbons, scientific instruments, optical goods, and machinery—all made of imported raw materials. The excellent hand-made watches of Geneva are the product of another industry well suited to skilled and intelligent people who import their raw materials. The small variety of her resources causes her to have a foreign trade of over $300 per capita. At that rate ours would be over

30 billion dollars per year (see introduction to chapter on the United Kingdom)

Government and people. Switzerland has one of the most democratic governments in the world, much more democratic than that of the United States The people on the south slope of the Alps, speak Italian Those on the north, as at Basel, speak German and those on the west, as at Geneva, speak French, but this diversity of race does not keep these people from feeling and acting like one nation It does, however, impose on them a lot of printing to publish things in three languages, and it makes the educated Swiss learn a lot of languages So does the hotel business. The Swiss are neither very poor nor very rich, but everyone is industrious and has a comfortable living.

QUESTIONS

1 How do unproductive mountains become the best asset of Switzerland?

2 Why can she supply herself with potatoes but not with bread?

3 Are her industries on a more or less permanent basis than those of Germany?

4 In how many different ways can you show that Swiss occupation is adjusted to the environment?

CHAPTER XXVII

HOLLAND AND DENMARK

Utilization of resources. Holland, officially called the Netherlands, and Denmark are two thickly peopled bits of shore plain. Holland has an area of 12,600 square miles and nearly seven

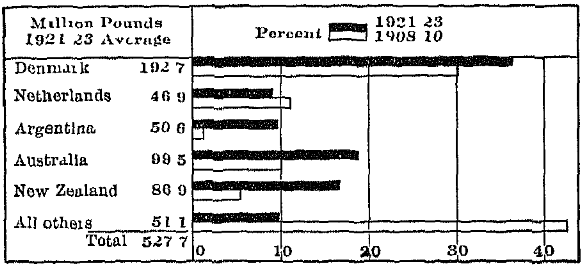


FIG 256 —World export of butter, three-year average.

million population; Denmark, 15,600 square miles, 3,200,000 population. These little countries are examples of prosperity on lands reclaimed by arduous labor. Holland's well-known sea-bottom reclamations are almost matched by the marshes and sand wastes that the Danes have converted into good pastures and fields. Holland also has considerable areas of infertile sand. Neither country has any coal or iron or other metals of any great importance. Holland even imports building stone by Rhine boats. The flatness makes water-power impossible, so manufactures must depend on imported coal. Materials and food for the worker must likewise be imported. We may therefore expect a full utilization of materials.

In this connection Holland has an agricultural industry that fits neatly into her situation. Bulbs of flowering plants, of which the culture of an acre costs over $1,000 per year, are raised by the carload and sent abroad to cheer the flower-lovers of every

land—ten million dollars worth per year The export of millions of little forest trees and fruit trees to the United States and other countries is another example of much labor and income from little land. In a country where land is arable and too valuable to remain in forest, the extensive use of tile roofing (made of local clay) is a good adjustment to resources

Intensive agriculture through dairying. While there is some manufacturing of diverse character and some fishing,[1] the countries are primarily agricultural, Denmark being a greater exporter of agricultural produce (per capita) than is the United States (Figs 256, 257). This comes about through an intensively operated

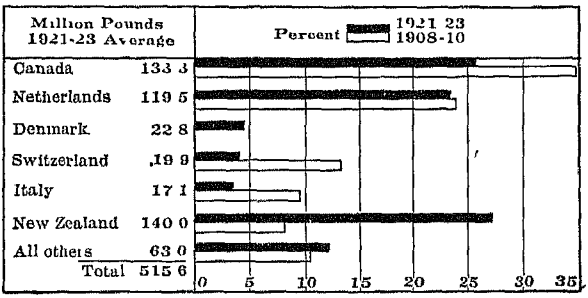


FIG 257 —World export of cheese, three-year average.

dairy industry The moist climate promotes the growth of grass, the natural food of cattle, for which these regions have long been known.

Holland, with 563 people per square mile, has also more live stock per square mile than Iowa or Illinois in the American corn belt

Denmark (136 people per square mile), like Holland, passed the limit in the number of animals it can support on native food, and cattle foods such as wheat bran, cotton-seed meal, linseed oil cake, and other grain products are being imported in large and increasing quantities from the United States, Argentina, and Russia. In the attempt to feed her cattle, Denmark grows three times as much barley as wheat and Holland is increasing her

[1] The Dutch fishing fleet is manned by only 20,000 men, less than two per cent of her male population.

area of oats and also increasing her acre yields Within 20 years her wheat yield has gone from 28 to 38 bushels per acre, and the potato yield from 200 to 274 bushels

Meadows which the Hollander has won from the sea by pumping water off the rich Rhine mud, are too wet for tillage, but make pastures of great richness Here drainage ditches separate from each other the little green fields, dotted with feed boxes from which the black and white cows eat bran and grains imported from America The Dutch make several pounds of butter per capita more than we make in the United States, but the Dutch being poorer, eat less of it per capita than we do. Their cheese output exceeds that of butter The town of Edam, west of the Zuyder Zee, has given its name to a kind of cheese produced largely in that part of Holland, and, along with other Dutch brands, it goes to England, to the United States, and even to South Africa, and many other countries where the fame of Dutch cheeses has spread Sweet butter also goes in large quantities to England

In the production of this commodity Denmark is the teacher of the world. That little country, about half the size of Maine is visited by the agricultural scientists of all the world who would learn in its best form the art of dairying Forty years ago she was a meat exporter to Great Britain, but the necessity of greater output has turned this democratic kingdom into a vast dairy farm. The Danish peasant owns a farm of from five to twenty-five acres More than half of the surface of the land tilled is in oats, hay, grass, and root crops to feed the cows. The increase of land used for forage has encroached upon the grain fields until there is not wheat land enough for bread As a result, Denmark with a poorer soil rivals Holland in the race for world leadership in large number of animals per square mile. There are more than a thousand factories for making butter; the cows are inspected once a month to insure healthy stock; and the dread disease of tuberculosis, so common among housed cattle of the entire world, has been entirely stamped out of the kingdom. Nearly 200 million pounds of butter is sent each year to Great Britain alone. and 9½ million pounds of Danish and Netherlands butter was shipped to the United States in 1923, despite an import duty of eight cents a pound. Danish butter preserved in tin cans has,

through its excellence, become the standard article for consumption in the tropics and in all the remote corners of the globe where there is no local supply

Danish bacon has an equally good reputation. All over Denmark it is cured by the same recipe, cut in the same way from pigs of the same breed, slaughtered at the uniform size of 180–200 lbs —the most economic size for a porker This standardization of a product, agricultural or manufactured, is of great advantage in increasing trade This Danish success has come largely through cooperation Groups of farmers, banded together in cooperative associations, buy supplies, breed live stock, test cows, run creameries and meat-packing plants, and sell farm produce

Foreign trade. Holland's location gives her a city population, supported by foreign trade which Denmark does not have Cities cluster at the mouth of the Hudson because the foreign trade of a vast region enters there. In the same way, Amsterdam, Rotterdam, and smaller towns on the various mouths of the Rhine prosper on the foreign trade, that feeds mouths and factories all the way from the delta to the Swiss waterfalls Meanwhile Denmark has but one city, Copenhagen, about the size of Buffalo

Poultry farming, developed in Denmark to a degree unheard of in most countries, is a prime example of cooperative efficiency The 60,000 or more Danish poultry raisers are members of an Egg Export Association which collected, packed, and marketed over 600 million eggs in 1922 The rules of the association are stringent Eggs must be collected daily and delivered to a branch of the association at least once a week By a simple control system of numbers stamped on each, any egg can be traced from the English breakfast table back to the individual producer Each bad egg costs the farmer a fine of $1 38. The second bad egg costs him still more, and the third is worse than three strikes at baseball, for he loses his membership in the egg association With such attention given to the satisfaction of the customer, it is no wonder that the Danish egg has become a prime favorite in England, which takes the largest share of the output, and that the busy Danish hen has been able to raise her product to third in value of exports

Questions

1 Why does the United States export less butter than does Denmark?
2 Why is Holland less able to compete in manufactures than she was in 1650?
3 Why does Holland, with not enough land to feed herself, devote good grain fields to the growth of flowering bulbs?
4 How has attention to small details paid Denmark?

CHAPTER XXVIII

NORWAY AND SWEDEN

Natural resources. Norway and Sweden are, for Europe, large and sparsely peopled countries. Norway has an area of 125,000 square miles, two and two-thirds million population, Sweden, 173,000 square miles and six million population The Scandinavian peninsula, which they occupy, is mountainous and extends far beyond the Arctic circle The greater part of both countries lies farther north than southern Greenland and is only saved from frigid desolation by the amazing influence of the Atlantic Ocean and the Gulf Stream which enable the Arctic ports of Norway to be open all winter when on the eastern side of the Eurasian land mass the port of Vladivostok, in the latitude of Bordeaux and Halifax, is frozen shut for months

The Arctic location, mountainous character, and recent glaciation explain the fact that 75 per cent of Norway is unproductive (except of water-power) and but 3 5 per cent is cultivated Sweden, having a considerable area of plain in the south, has about ten per cent cultivated Forests, mostly evergreen, covering 21 5 per cent of Norway and 52 per cent of Sweden, are, after agriculture, the greatest source of employment They furnish the chief export Both countries are heavy exporters of lumber, pulp, paper, and other wood manufactures Sweden is second only to the United States as a lumber exporter and she sends us much wood pulp for paper manufacture The snow-covered mountains furnish excellent water-power. The Swedes are able to sell power at astonishingly low rates in favored locations This also accounts for the development of electric smelting and the manufacture of nitrate fertilizers in which these countries take a leading place (see chapter on Chemicals)

Fisheries. The mountains and the sea meet along most of the coast of Norway. There is little farm land, and there are many

deep bays called fiords and 150,000 islands along the shore These facts, combined with good fishing banks (shallows) off the shore, have made sailors and fishermen of the Norwegians They are of all the nations save Japan, the most dependent upon fish. With its cool climate, its mountainous rocky land, and its coast full of bays, it duplicates in many respects Newfoundland and Labrador, and like them has great fisheries of cod and herring The cod are caught near the Lofoten Islands and the herring in the bays about Bergen in southern Norway The catch of fish is about five times as great per capita as in Great Britain Fish and fish products make up a large share of Norway's export, and Norwegian cod-liver oil and herring are known in many lands

Iron. Sweden is rich in iron ores, of which she mines more per capita than the United States These ores are the richest in Europe and are mined near the Gulf of Bothnia, beyond the Arctic circle. A railroad has recently been built from north Sweden across the Arctic mountains to the Norwegian coast, so that the ore may be exported in the winter When the Baltic is frozen over, Sweden has no coal, and like our own Lake Superior ore district, she exports most of her ore. Some of it comes to the United States, most of it goes to England and Germany. Sweden, with a large percentage (52 2) of her area in forests, has had the wood to keep on making charcoal iron, which is superior in quality to that of the coke-fed furnace, and is much sought by blacksmiths and machinists in many countries For example, Sheffield (England) cutlery is made of Swedish iron, and the Swedish production of charcoal iron is now giving rise to the manufacture of high-grade machinery in Sweden. Some Swedish exports of steel are worth their weight in gold

Agriculture in the Scandinavian peninsula is a combat with rigorous nature, less than one-tenth of the land can be used. We see the influence of the cold in the relative value of the crops In Sweden oats and potatoes come first, then rye, and lastly a little wheat and barley. Most of the breadstuff is imported. Hay and various root crops are grown for winter animal feed. The winter is long, and hay is so vastly important that the poor peasant must in some unfavorable locations actually spread the grass out under sheds to protect it from the rain until it dries, and then shelter it for winter use. To get to the barn it is at times brought down from heights on trolleys, traveling on wire cables. Such laborious condi-

tions of agriculture as this explain the emigration of Scandinavians to America, and we see why people who had been able to live in such a country quickly prosper in roomy America, with its more favorable climate and many opportunities Many Scandinavian farmers have a winter job at timber cutting In the spring freshets they follow the log drive down the river just in time to begin spring work on the farms.

Swedish agriculture is not important in world trade, as she does not raise enough food for her own population Cereals and other special food crops must be imported Dairying has advanced in southern Sweden, just across the sounds from Denmark. It seems that the Swedes learned the art of high-class dairying from their Danish neighbors and have become butter exporters.

In the extreme north of Norway and Sweden there is more Arctic moss than grass, and the reindeer becomes beast of burden, milk animal, meat animal, supply crop, and money crop of the Laplander This animal is the mainstay of Arctic man from Norway to the Bering Sea, and their meat is sold in many Swedish cities.

Textile and coal. There is some textile manufacturing in Sweden, and manufacturing industries are developing scientifically and in high quality like those of Switzerland Her future in manufacturing, as that of Norway, seems to lie in using the cheap waterpower of the mountains for the smelting of ore and the making of pulp and various other wood products By adding more labor to the raw products they now sell, the value of their exports can be many times increased. There is a little coal mined in Sweden, but the supply is inadequate and several million tons are imported from England which also supplies Norway.

Questions

1 How do the natural conditions enable Sweden to make iron of unusual quality?

2 Why may we expect manufacturing in Sweden to develop more than agriculture?

3 Why did the geographic conditions of Norway produce a race of bold sea rovers?

4 Would you say there is a natural basis for trade between Norway and Italy? Norway and England? Sweden and Belgium? Sweden and Brazil?

CHAPTER XXIX

THE NEW COUNTRIES OF THE BALTIC AND CENTRAL EUROPE

The World War. The World War has often been said to have shaken the world to its foundation.

If one looks at the maps of Europe before and after this struggle, it may easily be said to have shaken central Europe to pieces And for a few years after the new start some of these pieces did not get along very well with each other Some of these new nations are not on friendly terms with their neighbors The past has been so full of injustice and rivalry that bitterness exists in places where friendliness would far better serve the purposes of mankind One result of these bad feelings was that trade was greatly interfered with by tariffs, by which some observers said that some of the new nations were trying to strangle each other. Some of this foolishness has been remedied for anyone could see the loss it made, but there is still much to be done before these countries get along with their neighbors as well as the states of the United States do with each other

The first years of their independence were marked by frightful expenditures for armies In 1922, at the very time the Washington Conference on the Limitation of Armaments dared not touch the matter of land armaments, Poland and Czecho-Slovakia had armies as large in proportion as that of the United States at the moment of our greatest effort in the World War

Nation making. The comparison of the pre-war and post-war maps of Europe gives us the chance to see the process of history, in which a long view shows that state boundaries have flowed and ebbed like the tide Indeed, mediæval Europe was composed of hundreds of states just as the United States was composed of thirteen independent nations before they decided to unite and form the Government of the United States.

Every large European country shows us a similar process of consolidation More than a thousand years ago the famous King Alfred the Great of England united several warring kingdoms into

one—England. By royal marriages, the independent countries of Wales and Scotland were brought into the Union In Italy, the process of uniting several states into the one country of Italy did not occur until the middle of the 19th century The German Empire was made of a union of twenty-seven states in 1871 Mighty Russia became so mighty by the absorption of one country after another through the process of many centuries.

One of these pieces of Russian growth was the merciless division of the ancient and long independent Kingdom of Poland, of which Russia got the greater part and Prussia and Austria, two leading German states, got the remainder Another piece of the Russian advance was to take Finland in 1808, incorporate her as an almost independent part of the empire with the Russian Czar as her Grand Duke or Ruler, while the Finnish Parliament or Diet continued to do most of the ruling until 1900 Then Russia started in really to Russianize poor Finland, but fortunately she is now entirely independent by a treaty made with Russia in 1920 and she even got additional land through the cession of a part of the Arctic coast of Lapland

By similar processes of grab, Austria and Hungary had assembled groups of neighboring peoples and then formed a partnership called Austria-Hungary It was such a mixture of peoples that eleven different languages were officially recognized in the Imperial Diet or Parliament

At the end of the World War the attempt to give independence to the people of each important nationality entirely remade the map of Europe between the Arctic Ocean and the Black and Adriatic Seas. Rumania was enlarged, Austria and Hungary were separated and greatly reduced in size To the north of them six new nations appeared These countries fall naturally into this grouping· (A) The Baltic Border States, (B) The Danube Basin, (C) Czecho-Slovakia in the saddle between these two groups

A. THE BALTIC BORDER STATES

1. Finland

The people. The Finns, descended from a branch of the Mongolian race, are one of the most highly civilized people of the world They have a good university with many scientific societies, the

excellence of whose publication is known throughout the world Her surgeons, botanists, geologists, archæologists, and other scientists stand in the front rank among learned men For many years women have voted in Finland and have sat in her Parliament —not merely one or two as a curiosity, but twenty or thirty at a time They also have the wise provision that no one votes until the mature age of twenty-four

The achievements of the Finnish athletes at the Olympic Games of 1924 were so astonishing that there was some speculation as to the possibility of their winning, even against the United States, with thirty times as many people

The country. It is greatly to the credit of the Finns that they have attained this high mark in a country where nature is so

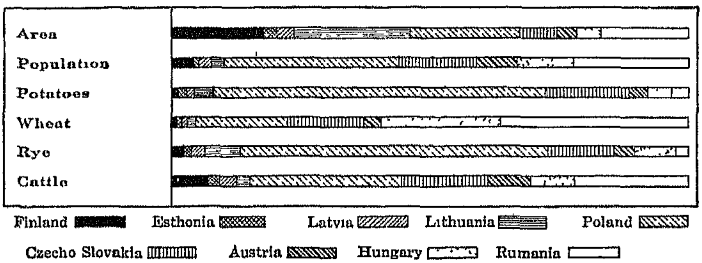


FIG 258.—A comparison of the nine new countries of Central Europe and the Baltic

hard that man can succeed only by much effort Look at the latitude of Finland, and see that it is in the latitude of Alaska Full half of the year is wrapped in snow and ice, only the warmest southern corner has a winter with a January temperature of 30°, the same as New York City, while most of it is much colder in winter. The summer is cool and agriculture suffers from early frost, which sometimes greatly injures the crops We shall probably get our best appreciation of Finland if we think of her as being like northern New England, New Brunswick, and adjacent Quebec The country was greatly torn up by glaciers, which left thousands of lakes, glacial hills, and much stone-covered land, so that the farms can be won only with hard labor The name Finland means country of swamps. One-tenth of the area of the country consists of lake or swamp, and only about one-sixteenth is cultivated.

Lumber. With such a climate and such a country, it is natural that more than half the surface should be forest, chiefly spruce and pine, but in the 17th century, forests of larch were planted Now each spring, with the melting of the snow, the Finnish streams carry down their burden of logs as do the streams of New England and Canada, and upon the melting of the fields of ice in the Baltic fleets of west European steamers hasten to the Gulfs of Bothnia and Finland to load cargoes of lumber, mine props, pulp, and paper from the many sawmills, paper mills, and log drives Wood furnishes 70–80 per cent of the exports and promises to hold this leadership

Agriculture. Five-sixths of the Finns live in the country (84 per cent), two-thirds of them are farmers and a great majority of the farms are small The crops are crops of the North, first in importance, oats, then rye, potatoes, and barley. They are growing good flax and hemp. There are many agricultural societies and many agricultural schools, but despite science and labor, her chief imports are cereals along with machinery and other manufactures.

The land of the Finns shows great promise as a future live stock region The dairy cows furnish millions of pounds of butter for export each year Taking a lesson from Denmark the farmers have established 500 cooperative dairies and over 700 egg-selling societies. Successful meat-packing plants are exporting good bacon

The nation and the prospect. A people with such a past and such attainments may be expected, now that they are an independent republic, to advance in civilization and they have made a good start by putting their house in order quickly after the World War They have always been a very hard working and thrifty people, and are not getting into debt They are paying as they go. They have added sugar beets to their industry with the most northerly sugar factory in the world Their leather industry is increasing and the quality of the product is improving Like Norway the country has large potential water power for manufacturing They already have a good system of canals connecting many of the lakes and have started in on a thirty-year plan of railroad improvement which includes a port on the ice-free Arctic where the North Atlantic Gulf Stream drift slips around

North Cape and produces the surprising result of leaving the Murman coast as free of ice as is that of New England Recent extensive iron ore discoveries near the port of Hango promise an important export.

2 ESTHONIA, 3 LATVIA, AND 4. LITHUANIA

The key to Russian history is the struggle outward toward the sea of the Moscovites from their ancient capital of Moscow, and much of the foreign policy of western European powers during the 19th century was aimed at as keeping her away from the Mediterranean, the Persian Gulf, and the Baltic. The Russians

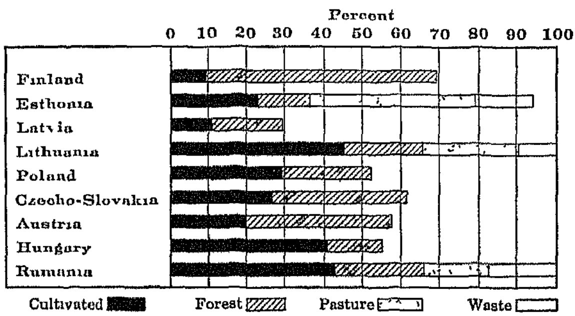


FIG 259 —Land distribution in the new countries of Central Europe and the Baltic

now declare with bitterness that the creation of these three Baltic states is merely one more act in the old attempt to shut Russia away from the sea.

But there is another reason, each of these states is the home of a people jealous of its rights *as a people* Because their lands are low, swampy, and naturally forested, the Esthonians, Letts, and Lithuanians have been able to maintain their language when separate languages melted away in a more open country where migration, travel, conquest, and assimilation were easier.

The Esthonians are cousins to the Finns, are dark-haired, somewhat slant-eyed, and speak a language that shows its relationship to that of the Finns, the Lapps, and other peoples of the so-called Ural-Altai group of Asiatics. They were such pirates

in the 12th century that various nations warred against them in self-defence, and the Germans conquered them Thus German Aristocracy held their land from that date to the time of 1918 when the peasants were permitted to take possession of the land that had been held in the large German estates for so many centuries. A problem now is—Can these new owners keep production up to the former level?

The Letts and Lithuanians are cousins to the Germans, tall, and fair-haired, but their languages are so different that German has to be translated to them

As in Esthonia the large German and Russian estates have passed into the hands of the small farmers All three of these countries are chiefly agricultural, with rye, oats, potatoes, and flax as their chief crops. In Esthonia, flax for the British and German mills and timber products are the chief exports In Latvia and Esthonia grain, meat, butter, and wood are leading exports and all three of them import manufactures of all sorts from Germany and England, and to a very much smaller extent from other countries

In strong contrast to Finland, Latvia is also just about self-supporting in food, exports and imports usually balancing This country suffered terribly by the World War, being ravaged by the Imperial Russian Army, the German Army, and the Bolshevik army. Nearly everything movable was carried away and the population of Riga (500,000) reduced one-half

Riga, on the Gulf of Riga, is the one large city in the three countries It is the natural port for so much of central Russia that along with the two other Lettish ports of Windau and Libau, Latvia handled 25 per cent of Russia's foreign trade in 1913. Riga was then one of the world's chief timber ports and Libau on the shore of the open Baltic is open to navigation throughout the year, save for three or four of the coolest days in winter, a matter of great importance, since Leningrad and all other ports to the north, except Reval, are closed with ice for a long period

Memel on the Baltic is the chief port for Lithuania, which has but sixteen miles of coast By ruling of the League of Nations, Lithuania has charge of the *port* but the *town* is self-governing. All three of these states are building port equipment to handle

the trade of Russia as Holland handles the trade of Germany—free of tax

Oil shale. It is surprising to find Esthonia leading the world in an industry—the utilization of oil shale—an industry promoted by the World War. The fact that the country has no coal and only a limited supply of wood led to experiment with the abundant shale In retorts it is made to yield oil, paraffine, and coke The crude shale itself is used as fuel in grates, stoves, lime kilns, cement plants, cotton mills, locomotives, and steamships Oil shale is most handy for the cement plant as it furnishes both raw material and fuel Another source of fuel, both for home and industrial use, is the abundant peat bogs of this country and both its small neighbors. In some cases peat is being used to run large power plants

5 POLAND

We should think of Poland as a nation rather than as another little state She has more than twice as any people as the three Scandanavian countries She is about the size of France, with two-thirds as many people Indeed, Poland has as many people as live in the wide territory between the Mississippi River and the Rocky Mountains, and when we think of the tiers of states from Louisiana to Minnesota, inclusive, from Texas to Montana, inclusive, we can see that the Poles are probably right when they declare that they are to be one of the powers of Europe.

The Poles are Slavonic people, cousins of the Russians, an artistic people who have produced persons great in music and the other arts as well as in the sciences

For centuries before our Revolutionary War Poland was one of the great states of Europe, but in three wars from 1772 to 1795 she was mercilessly dismembered and parts annexed by Prussia, Austria, and Russia. Despite three foreign conquerers, the Poles stuck to it that they were Poles They clung to their speech as to their skins and attempts to Russianize, Prussianize, and Austrianize them failed. They increased and gradually pushed Russians and Germans off the land, by sheer diligence and power of purchase, until at last Poland was restored by the Treaty of Versailles as an independent nation. Unfortunately the Polish population scattered out on the edges so that there are many

Poles beyond the Polish boundaries and many Germans, Russians, Lithuanians, and others in Poland. These people naturally do not like the Poles to rule them, and this is one of the troubles of this new nation.

Probably no country except Serbia was so desolated by the war. This is another of her troubles. The Germans threw Polish soldiers against the Russians, the Russians threw Polish soldiers against the Germans and the Russian and Germans fought over Polish territory until 1,500,000 houses were destroyed and as late as 1922 hundreds of square miles were still a tangle of barbed wire and people were living in dugouts with straw roofs. As a consequence, the new nation starts greatly in need of capital to rebuild and for equipment to develop her resources.

She has resources for both agriculture and manufacturing. The possession of as much coal as England, oil, zinc, lead, and salt and a very considerable labor supply and an agriculture that feeds her, gives Poland the promise of a favorable future if military effort does not exhaust her. Geographically her position is difficult, surrounded on every side by jealous enemy nations.

Agriculture. The rich level or gently rolling plains of Poland lie in the latitude of Manitoba with a wholesome climate, having cold winters and summers suitable for the production of all the small grains but too cool for corn. Her rainfall is satisfactory for agriculture and not too heavy. Droughts are not common and the population of nearly 200 per square mile compels a fairly intensive use of the soil. About half of the population are engaged in agriculture.

Her crops show the influence of the north rather than the south and occupy land in the following proportions: rye 4, oats 2, potatoes 1, wheat 1, barley 1.

This means that like Germany and North Russia Poland also is a land of black rye bread and boiled potatoes. The wheat is quite insufficient for home supply and is used by the more well-to-do, while the barley and the oats are for forage. She also has one of the three large sugar beet fields of Europe, and if her agriculture were as scientific as that of Germany, her product would be nearly doubled.

The most important factor in Poland's manufacturing is her

coal—the Silesian coal field Bismarck said that the nation which controlled the Silesian coal field was the master of Europe This belief explains the fierceness of the diplomatic struggle at Paris and afterward as to just where the Polish-German boundary should pass in the territory of this rich fuel deposit most of which was finally awarded to Poland by the League of Nations.

In Galicia, southern part of Poland, near the Carpathian Mountains, is the most important oil field of Europe outside

FIG 260—Bishop's Palace at Vilna, Poland A typical specimen of central European architecture, centuries old

of the one at Baku It has been producing about five per cent of the world's supply and half of it is being exported Poland also has an inexhaustible supply of rock-salt, and one-fifth of her area is in forest, which makes her self-sufficient in wood

Manufactures. Poland is an industrial nation to a larger degree than any of the other new countries of Europe. This is shown by her exports which are manufactured products rather than raw materials in the ratio of about two to one. Industry gives her many cities and there are more than fifty with over 25,000 popu-

lation At least three of the Polish cities have grown with the speed of American cities Warsaw, with nearly a million people, is larger than any city west of Chicago, and if in America would push Detroit for fourth place among our cities In eighty years Lodz has grown from a small settlement until it is now the peer of Kansas City, Mo , and Lemberg exceeds Omaha in size

Textile manufacturing is the leading industry, and mills for the spinning and weaving of cotton, wool, silk, and jute fabrics are found all over southern and western Poland Cotton spinning predominates and is centered at Lodz with its millions of spindles, often spoken of as "little Manchester" The cotton mills are restored nearly to normal production and but for the disturbed conditions in central Europe and the artificial tariff barriers raised by other nations, would have a profitable export

Trade. Poland's heavy population does not leave very much prospect of agricultural export unless it be such valuable products as butter, eggs, and sugar. She even needs to import some wheat, but her chief imports are raw cotton (three-fourths of it from the United States), phosphate fertilizer, and manufactures In addition to her textiles she exports iron and steel manufactures, coal, lumber, and oil Since the World War she has been securing over three-fourths of her supplies from Germany, which is a very natural source of supply

Nearly two-thirds of her exports have also been going to Germany. The natural market for Polish manufactures is Russia, but Russia at present is trading little. Before the war the cotton and woolen goods from Polish mills went to Russia, the Balkans, and to Asiatic countries

Danzig and the trade outlets. In making the Treaty of Versailles, two objects were kept in mind, one to let each people, so far as possible, rule itself, the other to give every nation an outlet to the sea.

Thus Poland needs Danzig, its natural chief port, but Danzig, with 350,000 people is a German city. This difficulty was met by making Danzig a free city under the protection of the League of Nations, which appoints a high commissioner who is a kind of Governor General The city is really a democracy governing itself. It is as though it were a kind of colony in the League of Nations and the success of this experiment will be very interesting and very

suggestive for the settlement of future difficult governmental problems

To reach Danzig, Poland was given a narrow strip of land, often spoken of as the Polish Corridor To the east of this corridor lies a part of Germany again, East Prussia with millions of Germans Thus a part of Germany's domestic trade passed through Poland and so must most of her formerly great foreign trade with Russia

B. THE DANUBE BASIN

The lower Danube Basin has much resemblance to the Missouri River Basin in Kansas, Nebraska, and South Dakota It is a land of cold winter, hot summer, and summer rain—a land of wheat, corn, and pasture The Valley is cut in two parts by the great arc of the forested Carpathian Mountains, which give a timber supply. This lower Valley is shared by four countries which own large parts of it—Rumania, Hungary, Jugo-Slavia, and Bulgaria Austria and Czecho-Slovakia own small corners of it.

1. AUSTRIA

With the one exception of government, Austria is a continuation of south Germany The navigable Danube flows from south Germany into Austria. As between Canada and the United States, so between Austria and Germany there is a similarity of race, language, culture, religion, form of government, and absence of natural lines of separation.

Austria is a sad political and ecomomic wreck Before the World War she was the ruling member of the Austro-Hungarian Empire which was larger than Germany and had a greater population then France Austria (with her 30,000 square mile area) has not one-eighth the area of the ancient empire, and with a population of 6,500,000 is but one-seventh as populous This population of 201 to the square mile is much more than the land can support, for most of its area is the hilly eastern Alps. Nearly one-third of the people are in the metropolitan city of Vienna, in 1914 one of the gay capitals of the world, to which travelers and students flocked by thousands from all parts of the world

The government of the later empire was a centralized government, which filled Vienna with soldiers, officers, and government

officials by tens of thousands, transacting the business for lands which the Treaty of Versailles transferred to the independent governments of Czecho-Slovakia, Hungary, Rumania, and Jugo-Slavia. To make matters worse the new governments did not take their proportion of debts, so Austria was left with a burden of debt which became fantastic, then the treaty makers solemnly imposed upon her billions more of reparation payments which she could no more pay than a schoolboy could pay. In great contrast to Czecho-Slovakia, Austria is hopelessly bankrupt, the imperial capital of Vienna became for a time a beggars' capital, living on loans, bread lines, and the sale of heirlooms, because the shorn little country could not support the city that was built for the capital of an empire.

As most of Austria is mountainous, less than one-fourth of the area is cultivated. Most of the remainder is in forests, that have long been famous for their good care and which are the chief basis of export save manufactures. Her chief crops are rye, oats, wheat, barley, and potatoes, but they do not suffice to feed her people. She has a very little coal and iron, some manufacturing of pianos, automobiles, and textiles, but the basis for the support of hundreds of thousands of the people was the imperial government. That government is dead and gone and readjustments for large masses of people are always slow and difficult. Fortunately the League of Nations arranged an international loan in 1923, reformed the currency, and gave Austria a start.

Four possibilities face Austria—new industries, migration, perpetual pauperism, or starvation. Another ray of hope lies in the fact—to be seen on any physical map—that Vienna lies at a natural focus of ways between routes going in four directions. This makes her the natural place for the financial center of much of the Danube region, and as it recovers from the war and becomes more prosperous, Vienna will regain some of her ancient business. (See section on Czecho-Slovakia.)

2. Hungary

Hungary is another of the states politically wrecked by the war. In the 15th century, Hungary was one of the most efficient military monarchies of Europe. For a long time she defended the rest of Europe from the advances of the Turks. As Austria's partner in the

late Austro-Hungarian Empire, the Magyars (Hungarians), were able to rule large numbers of aliens, chiefly Rumanians and Serbs The peace treaty handed the Rumanian sections over to Rumania, and the Serbian over to the new state of Jugo-Slavia, the Slovakian sections over to Czecho-Slovakia, so that Hungary lost two-thirds of her area and people

She was known before the war as an agricultural country, but the land cessions carried away thirty of her thirty-two paper mills, and nine-tenths of her forests which were in the Carpathian Moun-

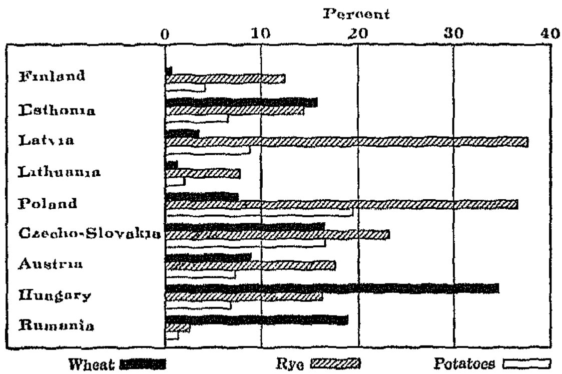


FIG 261 —Percentage of cultivated land in wheat, rye and potatoes.

tains and the Dinaric Alps. This of course made her still more completely an agricultural country

We could think of Hungary as being another Missouri or Nebraska As in Nebraska corn is important. In Hungary it approaches wheat in quantity, and the wheat in turn lords it over the other small grains by being twice as great in quantity as barley, rye, or oats, which we have seen were more important than wheat in the tier of countries on the Baltic The influence of the South is further seen in crops of tobacco and wine, and in the relative unimportance of the potato.

The European corn belt. The valleys of the middle Danube and its branches, the Theiss, the Drave, the Savem, and the Morava, spread out into a large expanse of level plain The normal crop of this region along with the Lower Danube and Duestan is from

350 to 400 million bushels a year, about one-tenth of the world's supply, and nearly equal to the crop of Iowa, our leading corn state. Although occupied by several different nations, the lower Danube Valley is like our corn belt, one economic region. To the north and west of Hungary the summers are too cool for corn growing. To the east of Rumania the climate becomes too dry and wheat replaces corn as it does in Central Kansas. Yet farther east we still see the Kansas likeness, for the Volga basin, near the Caspian Sea, does not produce any tilled crops, but it is a land of ranches and cowboys.

The Danube highway. The Danube is the great commercial highway of Hungary, as it is of Rumania. It lets ships go in one direction to the Black Sea, which is the chief avenue of the Hungarian grain export, and also connects by a small canal with the Main, a branch of the Rhine in southern Germany.

The natural source of Hungarian manufactured imports is Czecho-Slovakia and Germany, which supplied most of her needs before the war, and will doubtless continue to do so. The Hungarian capital, Budapest, increases the resemblance to our corn belt, by being a city larger than St. Louis.

3. Rumania

Rumania came out of the World War, with a gratified ambition. In 1859, two of the several Rumanian states, Walachia and Moldavia, east of the Carpathians, elected the same prince as their king. This founded the Rumanian state, and set up a keen ambition to have the other Rumanians in the same government with them. This was attained by the World War, whose settlement handed over to Rumania the Rumanian corner of Russia, called Bessarabia, and Transylvania, the Rumanian section of Hungary. Thus Rumania grew from 53,000 square miles to 122,000 square miles, and from 8,000,000 people to 17,000,000 people. Most of them are Rumanian, but there are a few scattered colonies of Magyars, Germans, and Turks, and several hundred thousand Jews. Eighty per cent of the Rumanian workers are busy on the farms.

We can best understand Rumania if we may liken her to eastern and central Kansas with the Rocky Mountains in its midst. It resembles Kansas by having corn and wheat as the chief crops, 100 million bushels of corn per year, and over 80 million bushels of

wheat There is a growing production of oats and barley, which sometimes equals the wheat, but rye is quite unimportant We see the Rocky Mountain resemblance in the Carpathians—forest-clad below, with mountain pastures and sheep flocks above, and many streams producing good water-power not yet utilized Another resemblance to Kansas is that this part of the Black Sea basin is a land where increasing droughts come to limit the corn belt and make wheat take its place.

Rainfall and prosperity. The sure relation between labor and harvest in Illinois and the great uncertainty in Rumania are enough to explain why one region is filled with progressive and aggressive farmers and townsmen and the other with poor and rather backward peasants using oxen for work animals Despite these handicaps Rumania, by exporting two-fifths of her crop, managed to send to Mediterranean and west European markets before the war, about one-third as much corn as the United States

Trade. When Europe settles down from the war disturbances Rumania will doubtless export more corn and wheat than she did before the war In 1921 cereals made up half of her exports, with barley leading The bulk of population in this corn region is rather poor. They depend for breadstuft almost entirely upon corn, exporting to western Europe the wheat which they also grow Steamers by the hundred load grain for west Europe at the ports of Galatz, Bralia, and Sulina on the lower Danube

North Rumania has an oil field with a small output, but it is very valuable to Rumania and furnishes an export at present second only to that of breadstuffs. She also exports timber, cattle, and pigs, which go to Italy and central Europe.

Rumania is more complete in her resources than many European countries She grows more cereals than she needs for her own use, all the meat and wool and has a surplus of petroleum and of timber. Her great lacks are steel and cotton and manufactures.

C. CZECHO-SLOVAKIA, THE NATION IN THE SADDLE

In the center of Europe, almost the exact center, sits Czecho-Slovakia. She sits in the saddle between north Europe and the Baltic states, and south Europe and the Danube Basin. She sits

in the saddle commercially, for her southlands are drained by the navigable Danube, giving access to the Black Sea, and her northlands by the navigable Elbe, giving boatway to Hamburg on the North Sea In her center is the Moravian Gate, a natural pass at the west end of the Carpathians, a natural highway from the Danube Basin to East Germany and the Polish Plain.

She sits in the saddle industrially for she has rich and well-balanced resources, farmlands, forests, minerals

She sits in the saddle politically for she has good natural boundaries Bohemia, the western part, the land of the Czechs, has mountains on three sides (with the Elbe giving a navigable pathway through them), and Slovakia, the land of the Slovaks, has the Carpathians for its northern and eastern boundaries

Czecho-Slovakia had a better start after the World War than any of the new nations

The Czechs were an independent people in the fifth century and along with their cousins the Slovaks became an independent republic by the Treaty of Versailles Their first President was a learned Bohemian who had been a professor in an American university.

So bitterly did these people hate the Austrian-Germans who had ruled them that a Czecho-Slav storekeeper in Prague one day refused to sell me something, because I asked him for it in German, a language he knew quite well

We might think of Czecho-Slovakia as being another Michigan, or Wisconsin, since she resembles these states in central location, climate, resources and industries, excepting corn

It has a rich, well-cultivated soil. Ninety per cent of Bohemia is agricultural land, a very high proportion of the total area, 32 per cent, is in a well-kept forest, of which the famous Bohemian Forest (Bohmerald) is a part Its agriculture shows signs of the south in its abundance of plums, and in the greater growth of wheat than in any of the other new countries to the north of it Rye and oats cover the largest acreage of the grains, closely followed by barley and wheat Potatoes is one of the most important food crops, and various root crops are grown for forage

The intensive character of its agriculture is shown by the great importance of the beet-sugar industry, which is twice that of France, and second only to that of Germany

Manufacturing. Bohemia has nearly all the coal of the old Austria, also some iron ore, nickel, lead, tungsten, and good glass sand. Thousands of Bohemians had gone to the German universities before the World War, and they had a good university of their own at Prague which is a fine and historical old capital city. Bohemian manufactures therefore resembled that of Germany. Before the World War she did three-fourths of the manufacturing of the entire Austro-Hungarian Empire. She came out of the war with her facilities increased through the making of munitions, and not ravaged by armies. Her busy spindles and looms, working on imported cotton and wool, turn out finished cloth for home use and export. The great iron works at Skoda, the breweries of Pilsen, her glass factories, sugar mills, tanneries and scores of other enterprises all contribute to her success as an industrial state. She is an exporter of iron, steel, sugar, glassware, coal, and wood, but cotton and woolen manufactures are her first export in value. Her trade shows that we should think of her as a Little Germany.

Trade and prosperity. Czecho-Slovakia is in much sounder condition than many of the new countries. She has an established foreign trade, her revenues are as great as her expenditures. She has a very small debt and did not depreciate her currency as Poland did. In each of the four years 1920–23 her exports were greater than her imports. The treaty that created this nation gave it interesting guarantees of trade outlets. The Danube is an international highway. Before the war it carried to the Balkans two million tons of Bohemian products per year. In 1921 the Bohemian government improved the Danubian port of Bratislava, so that it could handle three million tons a year. The Treaty of Versailles gave the Czecho-Slovaks a free port in a part of the Hamburg harbor, the free navigation of the Elbe, and they have leased wharves at Magdeburg, which is a halfway point in the four-hundred-mile journey from Prague to Hamburg. The Bohemian trains also have the privilege of running over the German railroads to Hamburg, and over the Austrian and Italian railroads to Trieste.

This central location with regard to route and countries shows how much she is in the saddle commercially. What she most needs is a treaty with a dozen or so of her neighbors whereby

they would do away with tariffs and have free trade with each other as do the United States of America The United States of Europe should be the great object of all the statesmen of that continent

In the summer of 1924, Hungary, Austria, Czecho-Slovakia, and Jugo-Slavia were conferring upon a Danubian Federation, and Esthonia and Latvia were negotiating for an economic and customs union These were hopeful signs of Europe's recovery.

Questions

1 Why is Esthonia particularly interesting to the people of states having oil shale?

2 In how many ways is the Gulf Stream of importance to Finland?

3 Should the League of Nations permit Lithuania to tax the trade of Russia that passes through her ports?

4 Why may Czecho-Slovakia be called a Little Germany?

5 What does the League of Nations have to do with Polish trade?

6 Why does the Rumanian wheat grower eat corn bread and use oxen for his work animals?

7 Show how summer temperature causes differences in the crops of three countries mentioned in this chapter

8 Which of these countries has the least need for trade? Which the greatest? Explain

9 Show how trade between Hungary and Czecho-Slovakia can be of advantage to both

10 What articles would the United States naturally export to Hungary and Rumania?

CHAPTER XXX

THE BALKAN STATES

Ancient history. The people of the Balkan Peninsula have puzzled the world by their outbursts of hatred, valor, and rapine Yet they are a natural product of environment and history. In 1683 John Sobieski, the heroic Pole, helped the Austrians drive the Turks away from Vienna, which they were besieging in their northwestward conquering march The Turks were driven back into the Balkans, an orderless, systemless chaos of mountains and little valleys, very difficult of access. Such places naturally lag behind in human progress, and the development of feuds between the people of isolated valleys is a common and world-wide occurrence Long before the Turks got possession of most of the Balkans these mountains had been possessed and peopled by various branches of the Slavic race On some of these peoples the Turks have exercised their genius for tyranny and misgovernment down to the present generation This combination of conditions tended strongly to perpetuate the conditions of the Middle Ages—the survival of many little almost independent communities having a strong local spirit and no broad patriotism

Poverty of the Balkan peoples. Meanwhile the people have remained poor, partly from isolation, and its consequent inability to trade and partly from misgovernment and tyranny. These influences have caused agriculture to be of a very primitive sort such as cutting wheat with the sickle, and in many places they have even yet limited manufacture to the household system After several years of independence the foreign trade of Jugo-Slavia is less than $10 per capita and that includes part of the Danube Valley Without isolation the Turkish tax system is almost enough to explain their poverty. The possession of property in the land of the Turkish tax-gather is dangerous. It makes its owner risk loss of his property, and also torture, if he does

not surrender it quickly Therefore why have property? The people of the Balkans, are poor also from sheer overpopulation· 100 to 130 people to the square mile is too many for such resources and such industries to support in comfort

Recent history. On this basis of misfortune, there was a terrible decade of war and destruction between 1912 and 1922. For generations the much hated sultans of Turkey had been sufficiently skilful in diplomatic finesse to keep their surrounding enemies jealous of one another and therefore separated But in 1912 by some new turn the Balkan haters of the Turk and haters of each other became united for one campaign, and Bulgaria, Serbia, Montenegro, and Greece, the four countries owning most

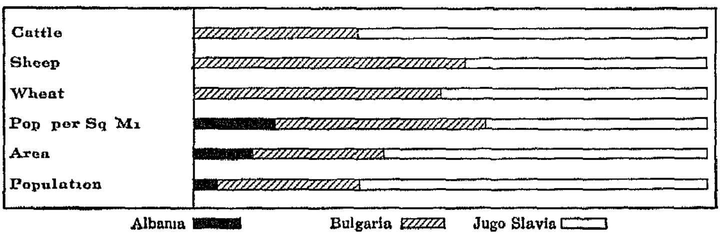


FIG 262 —A comparison of the three Balkan countries

of the Balkan Mountain country, joined in war against the Turk. It succeeded so quickly and so surprisingly that the new allies found themselves in possession of so much conquered territory that they fell into war among themselves when they tried to divide the booty This mutual destruction occupied them in 1913 It resulted in the quick defeat of Bulgaria In 1914 the World War opened with the invasion of Serbia by the Austrian armies They were driven back, but in 1915 German reenforcements and German artillery combined with ruthless pillage overran Serbia from end to end and destroyed her more than any other country was destroyed in the war—more even than Belgium. Bulgaria also helped Germany in this, being an ally of Germany in the war.

The war settlement created the country of Jugo-Slavia (South Slavia), officially known as the kingdom of the Serbs, Croats, and Slovenes. It was an attempt to put all of the southern Slavs

under one government and it added the old Austrian provinces of Bosnia and Herzegovina and Dalmatia to the ancient kingdom of Serbia. In 1921, at the death of old King Nicholas of Montenegro, this people, who were of Serbian race, voted to join the new kingdom

Albania, the southern neighbor of Jugo-Slavia, with 17,000 square miles and 832,000 people is about the size of New Hampshire and Vermont, and has a few more inhabitants Albania, however, has not a mile of railroad and a very few miles of common highway. These two facts serve to show the mediæval primitiveness of Albanian life In fact it is tribal in the hill part which makes up most of the country, so much so that in 1914 it was almost on the verge of civil war at the mere suggestion by their new ruler that they should pay taxes

Before the World War the Albanians had agreed that a German Prince, William of Wied, should rule over them, but in 1922, after the League of Nations got the Jugo-Slav troops out of Albania the Albanians asked to become a protectorate of the League of Nations.

The way the Balkans will not settle down was shown by the outbreak of war between Jugo-Slavia and Albania in 1921 and by the threats of civil war in Jugo-Slavia and also in Albania Indeed it is difficult for people who live in America to appreciate the bitterness of Balkan hatreds. The attempt to apply the principles of self-determination of peoples meets with great difficulty because the people are so mixed up In one village there may be Greeks, in the next Turks, in the next Serbians, in the next Croats, Slovenes, Albanians, Bulgarians, Rumanians, or even in some places, Germans No boundary line can include people of only one race. Further confusion arises from religion Most of the Albanians are Mohammedan The Serbs are Greek Catholics, the Croats and Slovenes are Roman Catholics. The bitterness of Balkan hatred is perhaps well shown by the Monastir barracks explosion of April, 1922, when in time of peace somebody blew up 800 tons of ammunition, killing hundreds of soldiers and civilians—one of the most terrible explosions in history.

The resources of the region are meager, about three-fourths of it is too rough for tillage, so that the mainstay of the people of the hills is flocks of sheep and goats, and of swine that eat acorns in the

Austria and France The large area of mountains, which are fortunately blessed with heavy rainfall, causes more than half of Jugo-Slavia to be in forest

We see signs of the intensification of industry and limited resource in the export of plums, plum marmalade, and prunes, we also see a promise for the future, because the most of this important plum export is produced by trees that grow half wild on the pastured hills Intensification appears again in the export of silk from Bulgaria, and in the production of attar of roses The growers of Damascus roses in Bulgaria give to the western world its supply of this precious perfume Its costliness results from the payment of from three to five cents per pound for the flowers, of which from 160 to 225 pounds are required to distill an ounce of the attar Unfortunately for Bulgaria the German chemists with their multitude of coal tar products have probably started the undoing of this Bulgarian industry by the creation of synthetic attar of roses as at an earlier date they undid the Indian indigo business with synthetic indigo or its coal tar equivalent.

The prospect. Much of the Balkans has never had a census, and much of it is utterly without roads, save the worn and gullied mule trails As a measure of their poverty, it is estimated that there is one horse to eighty people in Montenegro. The common draft animal is the ox. This beast is slow, but is possessed of two prime requisites for a poor country. He does not need grain as does the horse. He can eat the straw while man eats the grain, and later man can eat the ox—the work beast of poverty.

The Balkans seem to have considerable mineral resources—iron, coal, copper, gold, and oil, but they need peace, outside engineers and outside capital to help develop them In Bulgaria the export of petroleum was second only to cereals in 1921 and three-quarters of it was produced by foreign capital of which a part was American. It is time the age of science entered the Balkans with agents of construction In the past it has furnished them little but destruction—weapons to which the courageous and touchy mountaineer turns much too readily.

The introduction of the long-range, high-power repeating rifle into this land of mediæval industry, mediæval concepts, poverty, ignorance, racial jealousies, and old feuds, has produced untoward results in the fearful civil war that followed their successful war

against Turkey and in the continuance of local shootings Their primitive industry enables them to carry on a war better than a richer commercial people might have done At the end of harvest, 1912, the Balkan peasants and shepherds shouldered their rifles, took their bundles of homespun clothes, drove their flocks before them for food, and let the wagon loads of grain follow Thus were the armies equipped to drive the Turk from Europe in the first year that the Balkan peoples ever acted together

The new countries of north Europe have started as democracies. The Balkan countries stick to kings even if they have to send abroad for them. The Bulgarian royal family, like that of Rumania came from central Europe by invitation If ever people needed a benevolent despot, it is these ten million who occupy about 100,000 inaccessible square miles in the Balkans, and other millions on the surrounding plains. While benevolent despotism is the best kind of government, history records no means of keeping despots benevolent For 500 years the Balkan peoples have had the malevolent despotism of the Turks, and for the last half century they have been the pawns of the European powers in the game of empire. The theory back of the League of Nations idea is that the concerted action of well-meaning peoples will help those peoples that cannot get along well and peaceably without outside aid and control The Balkans offer a rich opportunity to show how the idea works.

In this connection the case of Albania and the League of Nations is most heartening The League stopped a Jugo-Slav-Albanian war, has sent commissions of advisers to Albania, and the schools, hospitals, etc., that Albania built in a few years were most encouraging

Constantinople

The governmental complexities of the Balkan region are richly shown by the fate of Constantinople In 1854-6 England and France fought the Crimean War against Russia to keep her away from the Mediterranean In the Russo-Turkish war of 1878 the Russian army was on the outskirts of Constantinople England ordered Russia to go back, and Russia obeyed At the end of the World War the victorious allies dared not take the city away from the Turks but surrounded it with neutral territory under the control of the Commission of the straits composed of representatives of

Great Britain, France, Italy, Japan, Turkey, Greece, the United States (if willing), Russia and Bulgaria (if and when they become members of the League of Nations) Meanwhile in 1922 the religious factor showed itself because the British Empire in India was threatened with Mohammedan revolution because the Sultan of Turkey, the head of the Mohammedan Church, was not given full control of Constantinople and also Adrianople, a city that had been conquered by the Balkan allies in 1912, retaken by the Turks in the second Balkan war of 1913, and handed back to Bulgaria at the end of the World War

Meanwhile Constantinople remains as she has been for thousands of years, a crossroad of the nations and the natural trade center for a large and rich region This has made her the largest city of the Mediterranean world and promises to keep her so The lack of a decent government has of course prevented much manufacturing development that would naturally occur there A Greek or Armenian jeweler, saddler, or shoemaker is willing to spread his tools on the work bench and ply his handicraft in a rented room where he would not dare build a factory Hence factory smoke has not spoiled the ancient simplicity of the beautiful city on the Golden Horn

Questions

1 Why are the Jugo-Slavs a pastoral people?

2 How has topography developed hatred in the Balkans?

3 Why is the slow ox preferred to the horse as a draft animal in some countries but not in the United States?

4 How have European jealousies kept the Turk in Europe?

5 How does England's Empire in India influence possible solution of the Constantinople question?

6 What good resources for manufacturing do the Balkan countries possess? What handicaps?

Questions

1 Why did Russia exceed the United States in rye, but not in corn?

2 How do climatic conditions give Russia nomadic peoples in the northwest and in the southeast?

3 What natural reasons have kept Russia so far behind England in manufactures? Which has the greater natural resources for manufacturing?

4 Why does Russia grow flax for fiber and Dakota grow it for seed? (See chapter on Textiles and chapter on United Kingdom)

5 Who owned Russian factories before the World War and what effect would this have on the relative value of her exports and imports?

6 Why does north Russia have the basis for the production of fine leather? (See chapter on Leather and Rubber)

7 How does the surface of the country encourage transportation and how has it encouraged the growth of the empire? Compare with Balkans in this respect

CHAPTER XXXII

THE NORTH MEDITERRANEAN LANDS

If South Carolina, Georgia, Alabama, and Mississippi happened to be four peninsulas jutting into the Gulf of Mexico, no one would

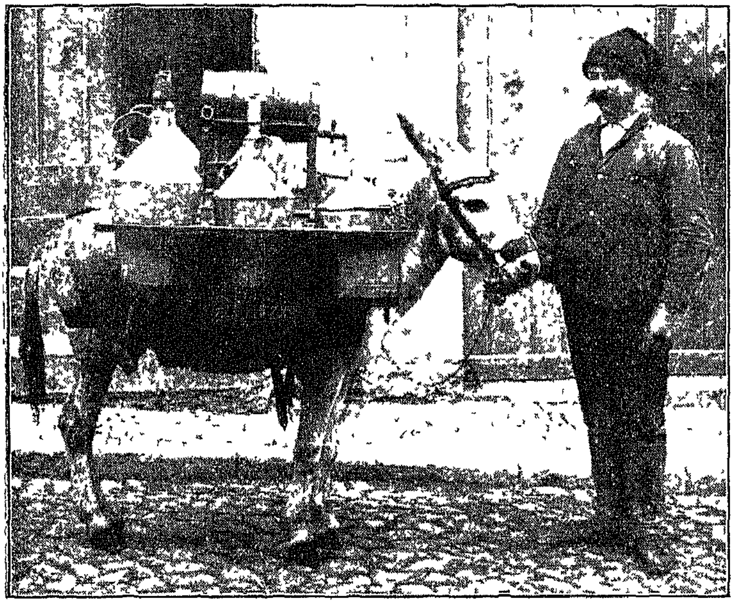


FIG 268 —The donkey, servant of the peddler of American oil in Portugal (Standard Oil Co) This wasteful pack transportation is used to a surprising extent in Spain and Portugal, and often where roads do not require it

think of giving each of them a complete description, because in many respects they are all alike The same is true of the Iberian, Italian, Greek, and Asia Minor peninsulas. They are bathed by the same Mediterranean, have the same climate, and therefore great similarity in products despite the great difference in their history.

The prime fact to remember about these lands is that they have a winter rain, a mild winter, and an almost rainless summer. This limits their extensive grain growing to winter grains chiefly wheat and barley (see chapter on Cereals). In addition to these winter grains agriculture depends first on irrigated patches where, in some little valley, water can be obtained Where this can be had the hot summer permits the growth of rice and corn, but like wheat, the supply of these is nowhere sufficient for home

FIG 269—Herd of goats waiting to be milked at the door of the customer, Granada, Spain

use Corn, being the cheapest of the grains, is extensively used as food—even cold corn bread, soggy at that, is relished by millions because they have nothing else and are used to it.

The next dependence of agriculture is on drought-resisting crops that can yield without irrigation or summer rain The dry summer limits alike the agricultural land and the forest land, and leaves a large proportion of land for pasture, but this same drought, of course, leaves the pastures brown and dead except on the higher mountains where the rainfall is greater The animals, like the crops, therefore tend to be of the drought-resisting sort In place of the horse we find the mule and the ass, especially

noted for their ability to survive coarse and scanty fare (Fig 268) Spain has three donkeys and mules to one horse and exports the best breeding asses in the world In place of the cow, the milk goat is a more common milk animal because it can get along without the green pasture Bushes suffice for it (Fig 269)

The olive is one of the neatest adjustments to the environment It survives the drought because it is deep-rooted and evergreen,

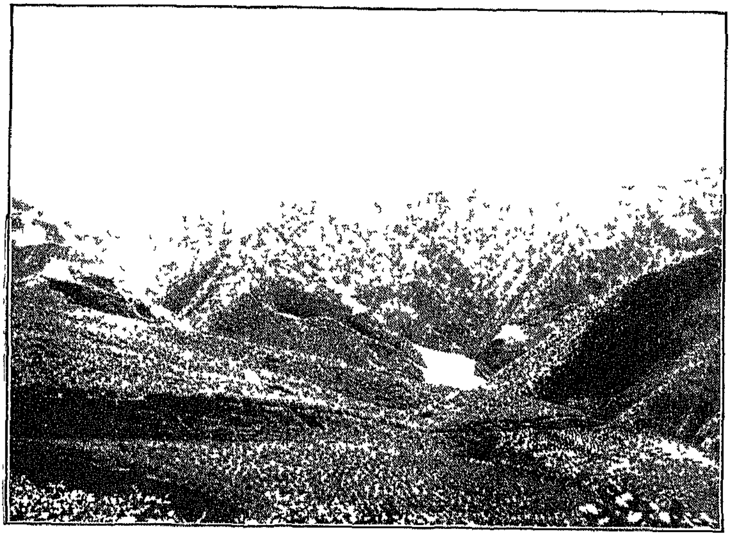


Fig 270 —Land near Granada, Spain, ruined by erosion The gullies are 200 feet deep The shiny places on top are all that remains of the original surface

with a leaf hairy below and glazed above to check evaporation It yields an oil that keeps for years and replaces butter and fat bacon in a land that is not well equipped to keep either cows or pigs It is the great butter substitute and fat food of the Mediterranean climate and some fat food is necessary to health The olive grows everywhere and thrives in poor and stony ground It is small wonder that the ancient Greeks called it God given. It lives for centuries, and in Spain it covers as much ground proportionally as does wheat in the United States. The Spaniard makes more

pounds of olive oil per capita than we do of butter in the United States The olive is a tree crop, a crop type of which the Mediter-

FIG 271 —Part of the same slope as that in Fig 270, steeper than a house roof, but, protected from erosion by oak trees This forest is used as a range for hogs which fatten on acorns from the oak trees shown in picture

ranean lands make great use "The almond is high in protein, the great factor in meat The walnut is high in both protein and fat, the oil of the olive is more nutritious than butter and far

more nutritious than any flesh of animals The fig is a real food, containing some protein and much carbohydrate, and a greater amount of nutriment per pound than bread."[1] The grape is a deep-rooting water searcher, so that wine production comes naturally into importance along the Mediterranean

All of these countries have been historic for over 2,000 years All have suffered great wasting of resources (Fig 270), and all are overpopulated in comparison to America and in relation to their resources Being scantily forested, brick and stone are the

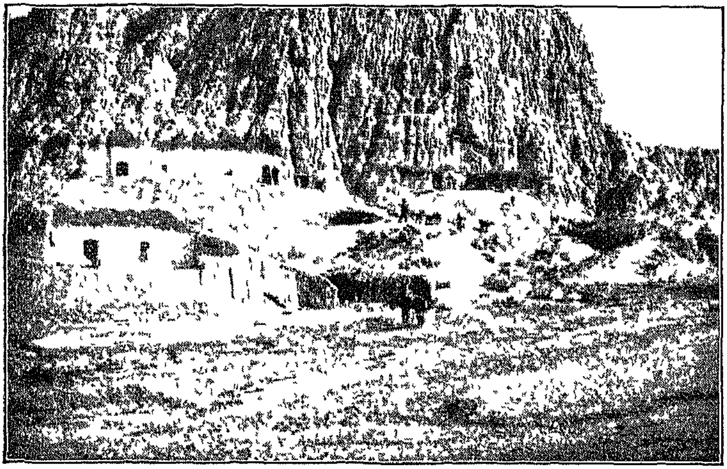


FIG 272 —Underground houses Thousands of people live in such homes in dry and treeless southeastern Spain

universal building materials[2] (Fig 272) All are without coal, and fuel is therefore scarce, suffering from cold is common in "sunny" Spain and "sunny" Italy Being devoid of coal and meagerly supplied with water-power (because of summer drought), the development of manufactures has been greatly retarded and

[1] From "The Agriculture of the Garden of Eden," by J Russell Smith, in the *Atlantic Monthly*, August, 1914

[2] The Italian earthquakes are so destructive to life because a common type of dwelling has arched masonry roofs and ceilings which crush the occupants

the heavy emigration from these countries to lands of greater resources and opportunity is most natural

The heavy population and the climatic limitations on the animal industries make meat scarce Italy has but 16 per cent as many cattle as people (compare the United States, see Animal Industries), and many of these are oxen The ox is the commonest work animal of the north Mediterranean The scarcity of protein food in the form of meat and milk causes the people of the Mediterranean to turn, therefore, to the cheaper forms of peas and beans. The gram or chick pea is said to be the leading article of diet in Spain, and is also greatly used by other Mediterranean people, including those of Morocco, Algeria, and Tunis, whence it is carried by caravans into the desert in exchange for dates In the agriculture of the eastern United States we have no substitutes (except navy beans, lima beans, and meat) for the chick pea and, its partner, the fève or French bean Both can survive some freezing and, like wheat, grow in the open rainy Mediterranean winter and ripen in the beginning of the rainless summer These plants are priceless to such lands. Lentils, vetch, and lupine, other pod-bearing pulse plants somewhat like our peas and beans, are much grown through all Mediterranean countries, and from the Isle of Cyprus there is considerable export of the flat beans of the carob tree, a legume It is often called locust and is widely used throughout Mediterranean lands as a substitute for oats in horse feeding and is said to have been the food of John the Baptist in the wilderness

The north Mediterranean countries are all mountainous, a condition which limits their agriculture, but they contain many little valleys protected from north winds by the mountains and warmed on the south by the sea, thus much favored for the growth of early vegetables (Fig 274) The northern mountains which protect [1] every one of these peninsulas from north winds combine with the nearness of the Mediterranean and the Atlantic to give winters that are much warmer than our American winters in the same latitude See what American cities are in Mediterranean

[1] The influence of mountains is surprisingly shown in the Crimea (peninsula in the Black Sea) Its central mountain mass causes the south slope to be so warm that oranges are grown for market What American cities have this latitude?

latitudes Where transportation to northern markets is good, as in Spain, Portugal, and Italy, this gives rise to a trade with north Europe like that from Florida and California to northern cities

Spain and Portugal. Spain and Portugal depend on agriculture more than does Italy, yet Spain does not have enough wheat or corn to feed her people Some corn is raised there without irrigation, but the yield is not high The cattle and hogs of Spain are only one-third as numerous per capita as that in the United States, but her sheep are three times as numerous Dry pastures like those of the Mediterranean are suited to sheep better than to cattle Both of these countries have large possibility of increased agricultural production Their backwardness arises chiefly from the fact that men of ability cannot attend to industry without losing social position The Spanish and Portuguese have ruled subject empires [1] so long that only military and official positions are considered honorable, and if not in office, one must at least be at leisure Respectability demands that the gentleman must be at the café, which is his club, and his estate is in the hands of the ignorant Thus scientific agriculture is still waiting to be introduced into much of these naturally rich countries. When one considers land, labor, and markets, the Iberian Peninsula offers some of the most wonderful openings in the world to the enterprising scientific agriculturist.

The people must work for low wages, because, through ignorance and bad methods, their output is small. At the beginning of the century cork forests in central Portugal were being grubbed for the removal of undesired bushes by gangs of women from

[1] Spain got vast empires by discovery in the Columbian epoch At the opening of the 19th century she had more than half of the West Indies, much of the western United States, all of Mexico, Central America, and South America except Brazil, also Florida and the Philippines In a century it was all gone, and sad indeed was and is the plight of the Spanish ruling class which has nothing to rule, cannot work, and is sorely in need of some money. The Spanish people in their poverty and ignorance (only one-third of them can read) are suffering from hunger, cold, pain, and needless sickness and poverty because of the want of an idea, the idea that it is respectable to work All this is proved by comparing them with the Danes—diligent, comfortable, patriotic, educated, and the half of them with money in the savings bank.

the more populous Oporto district They worked for $3 per month and their board, slept on piles of evergreen brush around the central fire in a big circular hut, and ate nothing but corn-meal mush, fifteen parts meal to one part olive oil They had all they wanted of it and it was better than they were used to, for they went back to their little farms in the spring fatter and in better condition than they came This occurred on the very edge of large expanses of good but untilled land

FIG 273 —Stripping cork in Portugal

The railways of Spain and Portugal, the banks, the factories, the mines, and many of the landed estates usually belong to the foreigners—English, French, German—because the foreigner has been willing to work while the Iberian gentleman could not At the outbreak of the war of 1914 large hydro-electric works being constructed by English and American engineers near the Pyrenees were discontinued because the money supply, which came from France and Belgium, ceased.

The chief exports of Portugal are wine, sardines canned in oil, and cork Cork is the outer bark of one of the oaks which lives for a century or two, and can be stripped of its bark, worth $75 per ton, every 9 or 10 years (Fig 273) It is an excellent crop for the absentee landlord because it requires almost no care.

It has probably helped to make the absentee landlord He is further aided by the fact that these oaks and the evergreen oak (ilex) yield acorns which automatically produce half the pork of Portugal, since the hogs range the forests and eat the acorns, thus harvesting the crop and feeding and fattening themselves

Spain also exports cork especially from her southwestern and northeastern provinces, and from the fertile and irrigated shore plains by Cadiz, Malaga, Almeria, and Valcenia there is a great export of oranges, grapes, raisins, onions, wine, early potatoes and other vegetables by steamer to the North Valencia oranges (irrigated) are famed The agriculture on these favored plains is very intensive and is well carried on by small proprietors who produce several crops a year

Aside from agricultural produce and fish, the chief exports of Spain are minerals from the foreign-owned mines, iron on the Biscay shore at Bilbao, quicksilver at Almaden, and copper and sulphur at Rio Tinto Spain is rich in minerals, as is Portugal, but both are backward in developing them. Barcelona, the capital of Catalonia, is the chief port and a hustling manufacturing city with a growing export of textiles The people of Catalonia are more enterprising than those of the south of Spain and are so democratic that they are a menace to the monarchy

Italy has several advantages over Spain Her past has left treasures that make her a cherished center of travel, and the beautiful Riviera, the coast of the Gulf of Genoa between the protecting Alps and the blue Mediterranean, is, as a winter resort, the combined California and Florida of Europe. It is a succession of hotels and beauty spots thronged by tens of thousands The southern Alps with their wonderfully beautiful lakes, Como, Garda, Lugano, and Maggiore, also enrich by drawing the tourist, but better than these as a source of human support are the water-power from the snow-fed Alpine branches of the Po and the irrigation of the fertile plain of Lombardy with its waters Turin and Milan are manufacturing centers, using hydro-electric power to turn the wheels of their machine shops, cotton spindles, and silk looms. Italy develops a million horse-power of water power and may develop three or four million. By comparing these figures with United States and Canada we see again the poverty of Italy, a nation that has not the resources to be a great power.

The Alpine streams furnish water for succulent pastures and hay crops, as many as nine per year in some places These are responsible for the famous Milan butter and for the few brands

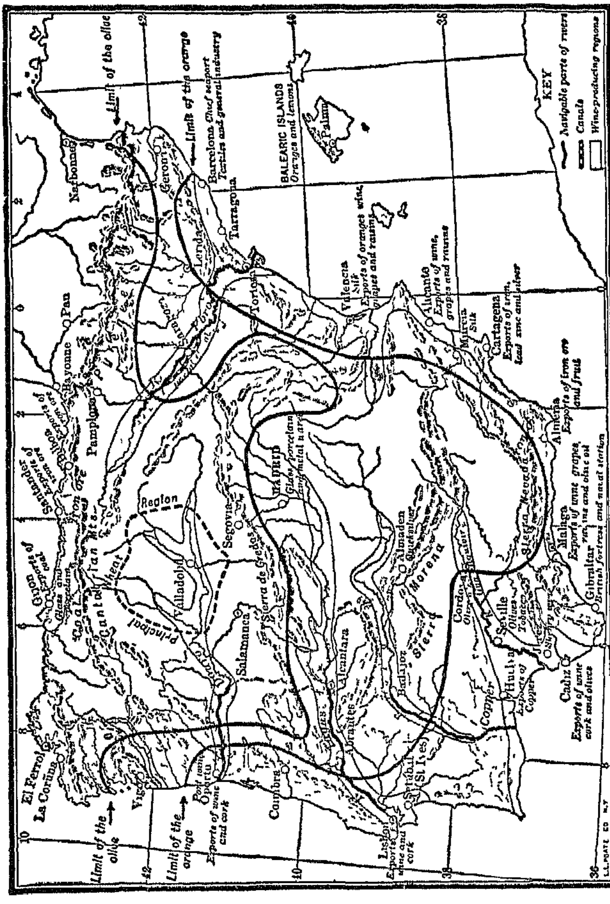


FIG 274 —Iberian Peninsula—production centers and influence of plateau and sea upon them (After Brigham)

of Italian cheese that are well known in many countries of the world One of these, the Parmesan cheese, is made of goat's milk. Cheaper cheeses are imported into Italy to feed her own

people just as the Dutch and Danes import oleomargarine from Chicago for their own use and sell the butter that they make

The mild climate of the level and fertile Po Valley is favorable to the mulberry tree, upon the leaves of which the silkworm feeds. Silk growing requires much cheap hand labor and the density of population in this district has given it the silk-raising leadership of Europe, although the amount of raw silk produced is not great

FIG 275 —Italian wheat fields planted with trees which serve as vine supports The trees are kept cut back except two long branches which are tied to those of adjacent trees Land is prepared and crop cut by hand.

when compared to Japan or China. About nine-tenths of the Italian silk manufacture comes from the district around Milan. The intensity of Italian agriculture is attested by the growing of wheat and other grains between the rows of mulberry trees, and the training of grapevines upon the outstretched limbs, thus obtaining three crops from the same land

Italy depends more upon grapes and wine growing than does any other nation. The limestone hills and dry summer permit grapes to thrive better than most other crops (Fig 276), and they are grown in all parts of the country Vineyards cover not less

CHAPTER XXXIV

THE OLD WORLD DESERT AND THE DESERT'S EDGE

The trade winds sweep equatorward from latitude 30° to 35° north and south to about latitude 10° to 15° They get warmer as they go, and if they come off of the land, they are drying, almost

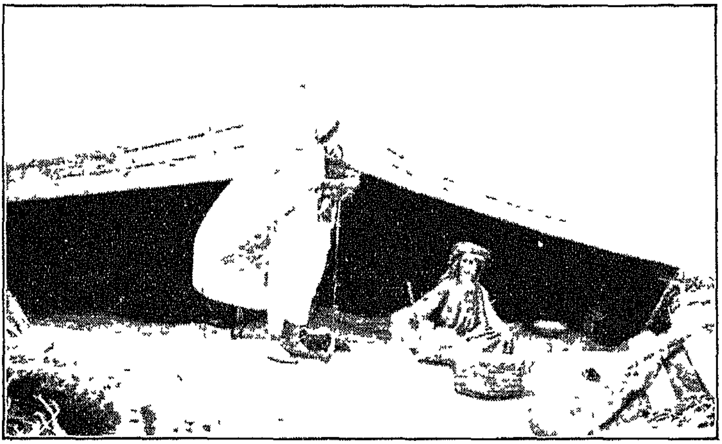


FIG 285 —Bedouin home Tent of camel's hair Flowing robe of homespun wool Basket of palm leaf fiber The woman is turning the family mill Fence of thorns at right to keep the animals out

rainless, winds Thus sand dunes are blowing into the sea at the west point of Africa and the dreaded Sahara envelops the whole width of that continent and the desert is continued (eastward across Asia) by the deserts of Arabia, Mesopotamia, Persia, Afghanistan, Trans-Caspia, Turkestan, and Mongolia It goes on to the vicinity of Pekin where the mountains of Chili and Manchuria shut out the moisture-bearing monsoon winds from the Pacific Throughout that almost inconceivably long stretch of

4,000 miles in Africa and 5,000 miles in Asia, there is an environment of great uniformity which by its severity holds man in an iron-bound control Everywhere in this 9,000 miles man lives by means that are greatly similar Here is the oldest social organization known, that of the Bedouin (Fig 285) and here in the valley oases of Egypt and Mesopotamia arose the first recorded civilizations.

Here and there throughout the desert and especially near its edges are oases where springs break forth, or ground water comes

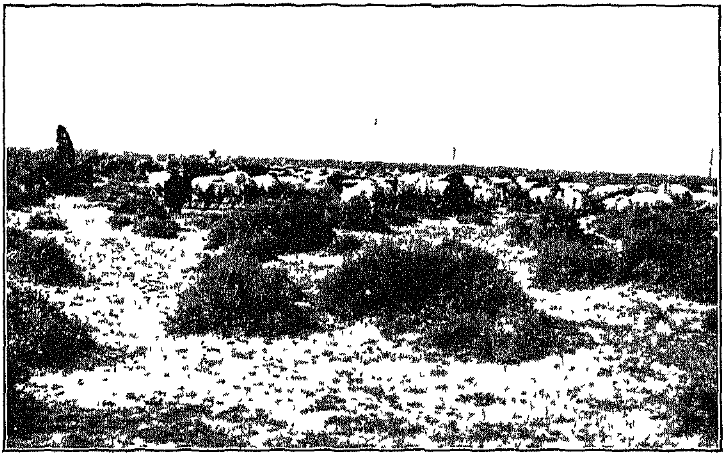


FIG. 286 —Desert edge vegetation, Tunis Rainfall 5 to 10 inches per year Bare ground with scattered bushes edible for sheep, goats, donkeys, and camels

near the surface, or where streams flow in from regions of better rain as in Egypt and Mesopotamia This water supply gives irrigation which, with the blazing sun, permits the world's most intense and productive agriculture This supports oasis, village, and town population. No part of the desert is entirely rainless, and some of it has scanty vegetation (Fig 286) which permits a little occasional pasturage. This increases in amount on the desert margins, and is finally interspersed with patches of land which will raise a little barley in good seasons This northern desert's edge partakes of the character of the Mediterranean climate The rain falling in the winter suits barley—where there is enough of the

rain The pasturage on the desert edge supports the same economic and social type, the nomad—Bedouin, Kurd, Kirghiz, Turkoman, Mongol, Afghan—according to his location.

The nomad, always facing starvation and other dangers, always on the move to find pasture, has been constantly schooled by his environment in the two great resources of the fighter—courage and transport. The environment has also given him hunger, a great motive to war or to plunder "No episode in all the history of the land has been so common as the raid of the nomads (Fig 287)

FIG 287 —Wall around Sfax, Tunis, built as a defense against the desert nomads before they were reduced to order by the French

From the treeless expanses they swooped down upon the dwellers of the oasis, and drove them forth The roving nomad was always strong in attack, the dweller in the date garden was always easy prey One cannot rightly guess the extent of the æons during which human history in southwest Asia and north Africa consisted of one long and essentially unvaried series of captures and possessions of the oasis gardens, these captures being followed by yet other captures and expulsions at the hands of other hungry victors "[1]

The influence of this environment on the nomad's idea of moral-

[1] From "The Agriculture of the Garden of Eden," by J Russell Smith, in the *Atlantic Monthly*, August, 1914, p 257.

ity is interesting evidence of the geographers' claim that environment makes man.

"What is an Arab to do when his camels, his sheep, his wife, his children, and himself are all suffering the pangs of hunger? The only resource under such circumstances is plunder. The man who is starving has little thought of right or wrong. To have such thoughts would seem to him fatal. If considerations of humanity or any other moral idea prevent him from engaging in raids upon the tribes around him, the doom of his family is sealed, for his children die of hunger. Thus through the thousands of years since Semitic nomads first lived in Arabia, the hard conditions of climate have steadily weeded out all who withheld their hands from violence.

"The man who would succeed and who would keep his children in health must not only be ready to commit depredations and be utterly dishonest according to our standards, but he must also be strong in the endurance of heat, thirst, and the weariness of long rides, unfortunately, however, he has little need of steady industry or of strength to endure long physical labor. In a word laziness according to our definition of the word, is no great disadvantage provided a man is able to summon up his powers in a crisis when the camels have strayed far away, when they have been driven off by raiders, or when the man himself goes on a foray. Hence the Arab is lazy as well as utterly disregardful of the commonest principles of honesty. Just as he thinks of raids as a part of the ordinary routine of life, so he thinks of steady work as something scarcely to be demanded even of women and fit only for slaves."[1] The career of the Arabs in Spain under another environment is an interesting contrast. With good valleys and water to irrigate them they established and maintained rich cities, splendidly tilled farms, developed science, universities, art, architecture, law, and stability, having for a time the highest civilization in Europe.

The nomad lives chiefly on barley bread, milk, cheese, and meat and dates which he buys at the oasis. Being a rover he is in a fine position at intervals to trade wool, skins, animals, or homespun, for dates at the oasis, barley on the edge of the desert, or weapons at the ports. There is no hurry. Nomads often stop for a time, raise a crop of barley, bury it for future use or load it on the camels in camels' hair sacks, and proceed.

Aside from the beasts of burden, the goat is the commonest of

[1] From "The Arabian Desert and Human Character," by Ellsworth Huntington, *Journal of Geog.*, Jan., 1912.

the nomads' animals Algeria had four million and Turkey 16 million before the World War, the whole world but 113 million Cows are rare except in the oases, but fat-tailed sheep are common The beasts of burden are varied Throughout the arid region from Morocco to Pekin the mule and the donkey, the short-distance burden bearers, climb the hills thread the mountain passes, browse on the arid plains in companionship with the camel, which braves

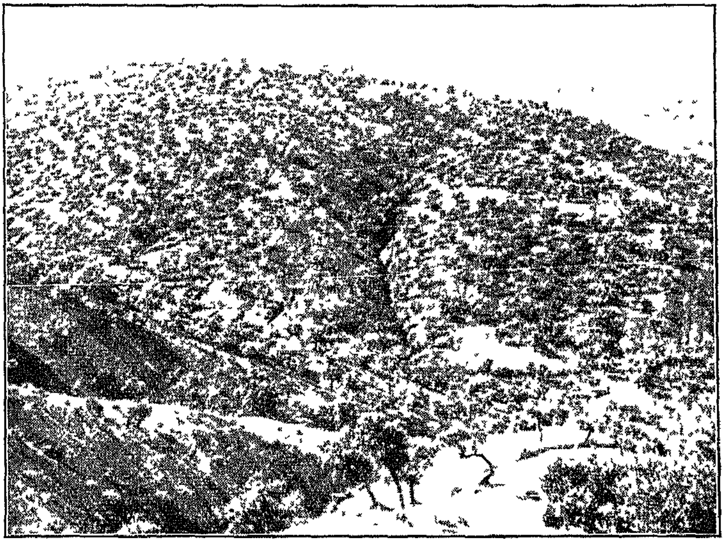


FIG 288 —Olive covered hill in Kabylia, northern Algeria

the worst desert, the ox that draws the creaking cart, and the horse that bears the proud chieftain

The oasis life is easy, especially west of Persia, because of that wonderful engine of production—the date tree.

"Now, as for the last five or ten thousand seasons, the date-tree owner begins his year's work in the springtime by climbing his tall trees to fertilize their blossoms The ascent is easy because of the natural steps furnished by the notchings left by the stubs of the leaves of past years The blossoms of the fruitful female palm are fertilized by a dust of pollen shaken from a sprig of male flowers in the hand of the husbandman This

economical device permits a very small proportion of male trees to suffice and the garden can be filled to crowding with the productive female trees Once the blooms are fertilized, little more is done for the tree but watering at rather frequent intervals, and this is often a light task, the mere diversion of a stream Many of the palms are cultivated only one year in three, but with this small labor they are heavy yielders The open feathery palm leaves permit much light to filter through, so that oranges, figs, and apricots grow beneath the palms, and garden vegetables can grow among these lesser fruit trees The vegetables pay the cost, the rest is profit, hence the oasis garden sells for a very high price (Fig 290)

"Thus the date garden leads all other kinds of agriculture in the amount of food produced, and this tree merits the title of King of Crops. Small wonder that the prehistoric Semite called it sacred Pound for pound, the date is as nutritious as bread, and when the harvest is weighed, it is three- to twenty-fold that of wheat After a score of years or less, the best wheat lands are exhausted by continuous production, but we know that certain oases have yielded dates regularly since they were visited and described by Roman writers, a score of centuries ago They are today so prized that the Arab owner will refuse $5,000 in gold for an acre of good date garden. Its yield warrants the valuation In May the oasis housetops beside the date garden are covered with drying apricots, in July and again in September the figs are drying, in late autumn comes the great event of the year, the date harvest

"The surplus dates are sold to caravan traders, who bring barley for the coarse loaf, animals for meat, and manufactures from over the sea. Since the house of sun-dried bricks is small, and keeping it clean is no necessity, the secluded and unlettered woman has plenty of time to run the ancient spinning-wheel, and hand-loom " [1]

We have here the basis of the whole oriental rug business. The oases east of Mesopotamia differ only in the absence of the date tree, and the greater use of grains, so that throughout the whole arid region we have pastures producing camel's hair, goat's hair, wool, and nearby, the dense oasis populations, living the life that preceded Abraham, and with nothing much to do but spin and weave and work leather. Further than this the valuable rugs and other fabrics can stand transportation any distance, anywhere by caravan, and they keep, with care, for centuries.

In north Africa is yet another type of interesting native life, that of the Berbers.

[1] "The Agriculture of the Garden of Eden," by J. Russell Smith, *Atlantic Monthly*, August, 1914, p. 258.

"The economic service that tree crops can render is well shown by the ancient Berbers who still live in the mountain territory of northern Algeria They were never conquered by Roman, Goth, Vandal, Arab, or Turk They made their first obeisance before the firearms of the French, 1857-61 Through all these millenniums they have lived in their populous villages perched high on the tops of steep hills (Fig 288) [1] Around them in all directions is a zone of trees, with pasture higher up, beginning at about three thousand feet, and the oft-conquered open

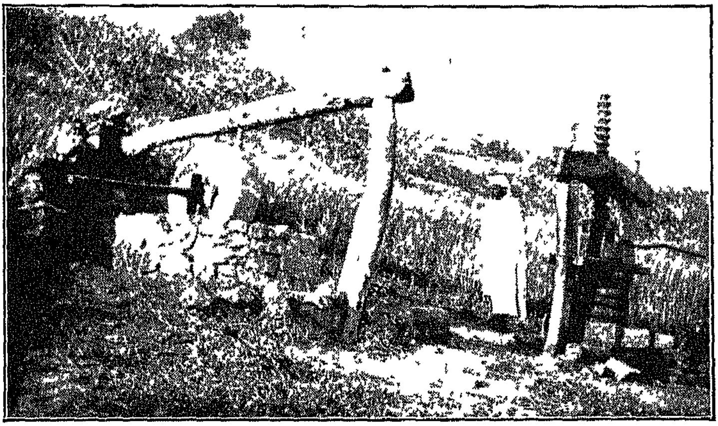


FIG 289.—Oil press, oil mill, barley, and native on the outskirts of a Berber village.

valleys below Here for unknown ages the Berber has lived among and from his trees (Fig 289)

"There are four staples of life in Kabylia—dried figs, olives, bread, and meat For miles and miles and miles there is one unending succession of villages set in this open forest of figs and olives (Fig 288) Here and there the better spots are picked out for grain fields and a few carobs are grown to spice up the donkey's diet of straw, and make a tidbit for the children (St John's bread, we call it) The sheep and goats which pasture beneath the trees furnish an occasional boiled or broiled joint and the much more important wool for the inclusive flowing robe of Arab style

[1] It is such tribes as these, and the dwellers in yet more difficult fastnesses that make so difficult the campaigns in Morocco where France and Spain sent many unhappy expeditions between 1908 and 1924 Being nearer the Atlantic there is much good grain land in Morocco

A diet of dried figs, coarse bread, olives, oil, and occasionally meat, may seem to us somewhat monotonous, but it has long supported a vigorous race A recent American agricultural explorer, Mr Thomas Means, states that the population of this region is twenty-five times as dense where tree crops are the chief dependence as it is where the same people make their living on the same hills by depending upon the grains and grasses"

North Africa. With European rule *western* industry is projecting itself into the midst of this native life at several points

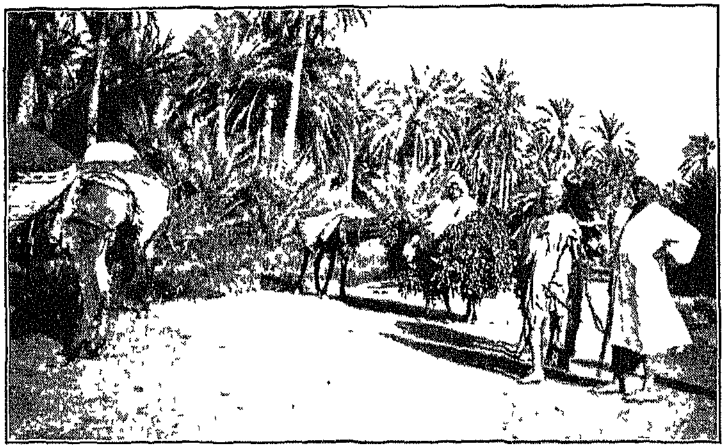


FIG 290—Road in the date growing oasis of Tozeur Donkeys hauling loads of manure to and alfalfa from the gardens

The French have conquered and colonized Algeria and Tunis. They are conquering Morocco and the Italians are conquering Tripoli, a task made difficult by the mode of life prevailing there. Half a million nomads or less in Tripoli have been harder for Italy to conquer than would have been 50 million oasis dwellers When the army goes to attack, there is no one there After it has camped two months and grown weary with waiting it is suddenly attacked at dawn by a force of fighting fiends. The success of the defenders was so good that after 15 years, 1907–1922 the Italians granted Tripoli a form of self-government that is almost independence

The immediate shore region of north Africa west of Tripoli

is possessed of the true Mediterranean climate and all that goes with it. The shore plain and the north slope of the Atlas has enough winter rainfall to grow wheat, olives, and wine, as do the lands on the other shore of the Mediterranean. Wine exceeds all the other exports. These crops the French colonists are growing largely with native labor, and along with cork, wool, and skins, they are the important exports. The southern location also enables Algeria to export potatoes and other early vegetables, and oranges, to France and north Europe. Politically Algeria is a part of France and has one-eighth as many people.

Tunis, which was for Rome an important source of supply for wheat and oil, is still exporting both and is having rapid extension of its olive orchards. The excellent quality of Tunisian olive oil has recently led American buyers to import it direct, instead of through French and Italian middlemen who "blend" it with cotton-seed, peanut, and other oils.

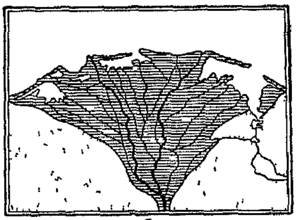


FIG. 291.—The Nile delta surrounded by the desert shown in dots. One of the first oases in the world with a close counterpart in the Imperial Valley of California.

Several French railroads, largely military in their purpose of construction, have been built across the Atlas mountains and into the edge of the Sahara in both Algeria and Tunis. This is stimulating the date trade from the oases which had before depended upon the camel. There is a little trade across the desert, employing about 30,000 camels, but it is insignificant for two reasons: the great danger of robbers, and the increasing ease of reaching the Sudan from the South.

Egypt, with an area of 350,000 square miles and a population of 13 million, is now as it has been for most of the last 7,000 years, the world's greatest oasis. But for the Nile it would be all desert. The cultivated and settled area, consisting of the Nile Valley and the Delta is only about 12,000 square miles, most of it a narrow strip a thousand miles long and one to nine miles wide. It has the Sahara climate, but is irrigated by the Nile, fed with rains in equatorial Africa (Fig. 291). The great advantage of this annual irrigation by providence made an easy food supply which

enabled the Kings of Egypt to build the pyramids when our ancestors were living the life of a primitive people in an unknown place. The country was of late a British protectorate for many years, but in 1922 proclaimed its independence and became a separate kingdom but England still has some influence in the government. Under the continuous heat, sunshine, and irrigation, the Egyptian farmers regularly get two or three crops a year, wheat and barley in the winter, cotton and rice in the summer, and rice, corn, millet, and vegetables in the autumn. There are excellent resources to grow sugar, but Egypt plays an unimportant rôle in this respect because her population of 930 per square mile of utilized land demands rice, corn, and beans, and clover for the work animal, whereof the acreage far exceeds the sugar acreage.

While the Nile Valley of Egypt is good for sugar, it is without question the best large cotton field in the world. With alluvial soil of the Delta fertilized annually by the flood waters, with almost continuous sunshine and a climate in which there is a steady rise in temperature from spring to summer and a steady decline from summer to autumn, this valley produces 500 pounds of cotton per acre, which is double the yield of any other country. Unfortunately, its area is not great. The quality of Egyptian cotton, owing to its long, strong fiber, is better than that of any other except Sea Isle. It commands a high price, and the production, which covered 1,350 square miles, or one-seventh of the cultivated area in 1885, increased to 2,920 square miles in 1922, an area greater than that of any other crop and covering one-fourth the fields of Egypt. Cotton is there a recent industry and can only be grown by frequent irrigation, which has been possible only since the introduction of modern engineering devices under European management (Fig. 292). The ancient native method of irrigation was to let the river overflow the land at the time of the flood. The water was caught in ponds or basins and held there until it soaked into the ground leaving its thin but restoring layer of rich yellow mud. Seeds of grain, beans, and vegetables were sown in this mud and produced a crop from its soaked earth, only one crop a year.

The greatest of the British efforts at cotton extension is the building of the Assuan Dam, completed by the British in 1902

at an expense of $125,000,000 It holds back vast quantities of water from the season of flood until the time of need and permits irrigation at all seasons Flooding of the Nile has annually spread a layer of mud over the Egyptian fields, permitting continuous cropping for many centuries without any other fertilization Already there is complaint from the natives that the fields of

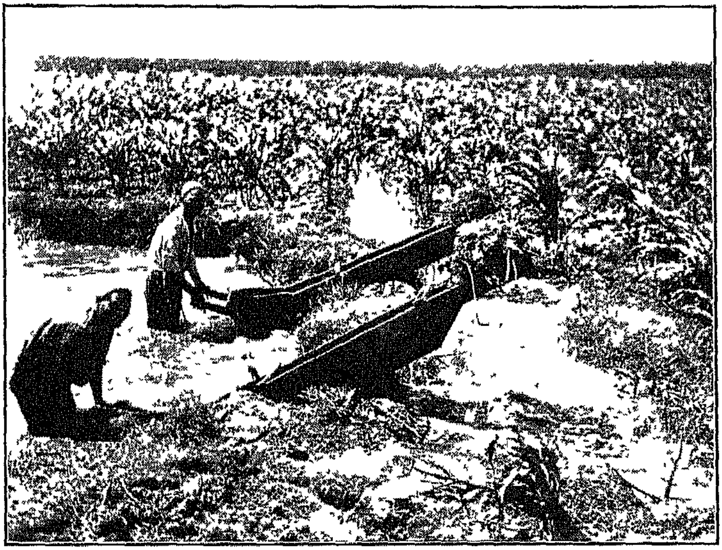


FIG 292 —Lifting water by the rocker process in Egypt One of the laborious processes by which the Eastern peoples get water to their crops

lower Egypt are declining in fertility since the Assuan Dam shut off some of the floods and the mud

We see the stubborn conservatism of the oriental agriculturist in the surprising fact that even in Egypt highways are little used, and that the donkey and camel are the chief means of carrying produce to the railroad and the steamboat introduced by the white man but *used* by the native.

Arabia, Palestine, and Syria. Most of Arabia is desert, so absolute that it cannot be crossed between Damascus and the Indian Ocean. So far as known but two white men have made the journey

from the Red Sea to the Persian Gulf since Roman times In the extreme southern point is Yemen where mountains near the sea make a little area moist enough to be the home of Mocha coffee Here the shade-loving coffee tree has the advantage of a mist, which arises on the lower plain almost every morning in the year and toward noon envelops the coffee-planted slopes in a haze which keeps off the full rays of the sun and also gives the proper moisture for the good development of the plant and the production of its seeds

The fine quality of this Arabian coffee is due chiefly to the fact that it is carefully prepared, most of the crop being bought on the trees by Turkish and Egyptian merchants who personally superintend the harvest The amount of coffee grown in Yemen is much smaller than that which is sold under the name of Mocha and it is much smaller than the demand. In Yemen coffee is purely a money crop, and is not used by the natives, who drink a decoction of the dried hulls. Only a small proportion of the Yemen land suitable for coffee is planted to that crop. Most of it is in dhurra, a grain resembling millet, which is the chief food of the people.

In the center of Arbia is an upland with more rain, and the streams that flow away from it water many populous oases hidden away far in the interior little influenced by any rulers of the coast.

The northern part of the east coast of the Red Sea has become the independent Arab kingdom of Hejaz, where the Arabs are trying to have a kingdom all to themselves as the Turks are in Anatolia.

Some oases on both sides of the Arabian Desert yield dates, particularly at Oman near Maskat, where they are an important export.

The Arabian horse, choice pet of the sheik or chieftain, sprang into literature from the Crusades On the race course he is not so swift as the more carefully selected English breeds that are in part descended from Arabian stock, but he is an animal of great endurance

Palestine and Syria are a fringe between the Mediterranean and the Arabian desert which holds sway beyond Jordan. They are much like Algeria or Greece, lands of wheat and barley, olive, wine, sheep, goats, and donkeys.

The city of Damascus is a kind of little Egypt. It stands in and is fed by a fertile plain watered by streams flowing down from the east slope of the Lebanon Mountains to lose themselves in the desert.

Both Palestine and Syria have been much disturbed since the World War chiefly by the continued trouble made by the Arabs who did not approve of the Paris peace plans.

The region around the head waters of the Tigris and Euphrates is but an arid pasture like the highlands of Arizona or New Mexico The methods and the difficulties of the live-stock industry in this region are shown by the following excerpts from a United States Consular Report from Harput, Asia Minor (June 17, 1911)

> "A great portion of the cattle, sheep, and goats are owned by nomad tribes of Kurds that wander about this whole country with their flocks and herds This last winter, however, was the most severe ever known in this country. The snow extended south even down into the sub-tropics, and over this winter-grazing land the snow was several feet deep and lasted throughout the entire winter The people were helpless to provide against such conditions There was no food procurable for the live stock and little for the inhabitants, 20 per cent of whom and 70 to 80 per cent of the live stock starved to death
>
> "Almost 300,000 head of sheep, one and two years old, were being driven from Sulemania, Kerkook, and Mosul toward Aleppo and Alexandria (Syria) to be shipped to Alexandria (Egypt) for mutton, 90 per cent perished en route."

Since that date there has been a single snow fall of 40 inches reported for Jerusalem showing what tricks the weather can play

Mesopotamia. The flood plain of the Tigris and Euphrates, the site of Babylon and Nineveh, and the seat of many empires, has at times been a better oasis than Egypt. It has lain waste for several centuries since the Turkish conquests. The large and prosperous community, depending upon one irrigation canal for its very life, was a particularly easy victim for the Turk in the exercise of his genius for misrule. The farmer depending upon rainfall had at certain times certain crops that could be taken, but it is reasonably easy to keep enough to save life The herdsmen may get out of sight with his flocks, as the centuries-long strife of Bedouin and Turk attests, but the band of Turks

at the head of the irrigation canal held over the heads of the irrigationists the power of life, death, and all exactions Hence the desolation and unused possibilities of Mesopotamia with a fine navigable river flowing through its wasted midst from Bagdad to the Persian Gulf. In December, 1913, an English-built dam and a reconstructed irrigation canal were opened to service, through a concesssion granted by the Young Turk Government which was then in control at Constantinople During the World War Mesopotamia was conquered by British troops and has become an independent state, the kingdom of Iraq under a British mandate The valley is as good as it ever was and will make a home for millions. Some of the canals of the ancients only need repair. Persia owns a part of the lowland and produces largely of dates shipped by steamer from Basra on the lower Euphrates whence we get most of our supply

Added interest is being taken in Mesopotamia because of the recently discovered and very promising oil fields near Mosul. There has been keen rivalry for concessions. The English, anxious for a source of cotton under their own control, are also looking to these hot valleys for a future cotton supply.

Persia, with an area of 628,000 square miles and a population of 9,500,000, and Afganistan with an area of 245,000 square miles and a population of 6,380,000, are high arid plateaus with scanty pasturage and occasional oases, connected by long and difficult caravan trails Most of the Persian population lives in densely peopled irrigation settlements where some stream fed by mountain snows flows down with water enough to irrigate a plain at the foot of the mountain. This is much like Damascus or Salt Lake City. Like these two also, the Persian settlements are surrounded by vast arid pasturelands, and over these Kurds, Arabs, Turks and other nomads follow flocks. Skins are a natural export. This is also a natural setting for the rug industry in both tent and town. Some of the oases produce silk and opium, marks of intensive agriculture.

Persia possesses a little of the Mespotamian lowland, rich, oily, irrigable, accessible to ships. This small section accounts for the leading exports of Persia, petroleum, cotton, and fruits, chiefly dates from the bank of the great river.

Nearly all Asia passed unto the possession of colonizing powers

but these countries remained independent, suffering from grievous oppression and misrule and devoid of roads or railroads because neither England not Russia dared annex them for fear of war with the other.

Central Asia. The mountainous backbone of Asia, which skirts the northern boundaries of Persia and Afghanistan, becoming ever higher as it approaches the Himalayas, makes the aridity of central Asia more intense than that of Persia. Between the Caspian Sea to the upper Hoang-ho, a distance greater than from Boston to Salt Lake City, lie Russian Turkestan and Chinese Turkestan. At the bases of the mountains where the mountain streams flow out into the plains there are irrigation settlements, depending in size upon the size of the streams. Many of them are older than London, Paris, or Athens, and they vary in size from mere hamlets to considerable cities like Kashgar (pop 60,000), Samarkand (89,000), Tashkent (271,000), Bokhara (75,000), and Merv, names that are well known in the rug markets of the world Some of these plains away from the mountains, especially in Chinese Turkestan, are so arid that crossing them is most difficult, but upon the mountains there is good summer pasture

The Russians, after conquering the native states of Turkestan, built a railroad about 1,500 miles long to connect these oasis cities with the Caspian, and another to connect with Russia direct (see Fig 303). Before this they had depended for ages on the slow and expensive caravans The railroad made two sudden industrial changes. Cotton and the dried apricot, which had been produced for local use from time immemorial, suddenly found a great market in Russia Within two decades after the railway was built, cotton became one of the most important money crops from the irrigated fields of the oases which are fed by the melting snows of the high mountains of central Asia The product, however (950,000 bales, pre-war average), was insufficient for the needs of Russia, and there is small possibility of its large increase because of the very limited areas for which it is possible to secure water Before the war one-fifth of the irrigated land of Turkestan was in cotton, and the Russian government was trying to double this by arranging for an outside supply of wheat so that the wheat lands of Turkestan

could be put to cotton This poverty of cotton land shows up when compared with Louisiana where about one-twentieth of the area is in cotton, and, with adequate drainage works, almost the whole state, 29 million acres, 45,000 square miles, is fit

The whole of this region of the Old World Desert and the Desert's edge is very promising as a field for future mineral development, excepting coal Peace, security, and railroads, however, must come first. For instance, railroads in southwestern Tunis bring to the port of Sfax hundreds of thousands of tons of phosphate rock from low-grade deposits of vast extent Bedouins who want some money often come here and work for a while Persia especially seems to be rich in minerals, and is starting with a promising petroleum development.

Questions

1 Why is the desert's edge a natural place for the production of the hand-made rug?

2 What is the natural basis of conflict between the oasis dweller and the nomad?

3 Is the Bedouin a nomad because of his environment or because of qualities within himself?

4 Why does the United States with much cotton land import cotton from Egypt with little cotton land?

5 How have the English increased the area and reduced the fertility of Egyptian fields?

6 Predict the future of Mesopotamia.

7 What changes have recently taken place in the character of the exports of Russian Turkestan? Is there any American counterpart for this?

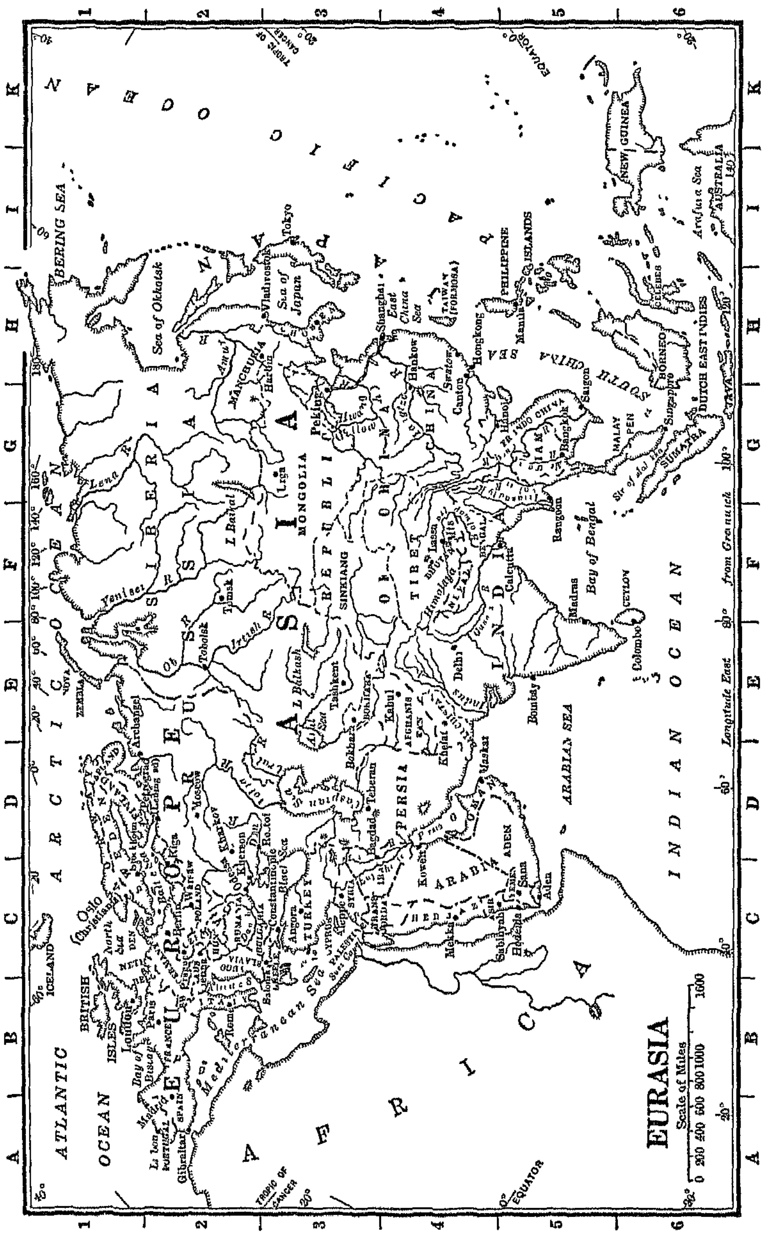
8 Can you show how Old Testament narratives reflect the geography of the lands where the writers lived

CHAPTER XXXV

CHINA, JAPAN, AND KOREA

The monsoon climate. The vast land mass of Asia, more than five times the size of the United States, gets so hot in the summer that the heated air rises, and air flows in from the Indian and Pacific Oceans to take its place. These are rain-bearing winds and they come in from the sea all the way from the Indus River in western India to northern Japan This three months' rain-bearing sea breeze is called the monsoon, and it is the most momentous single climatic fact affecting the human race, for it feeds the half of them In discussing the Mediterranean lands it was shown that the dry summer was a great limitation to any land The monsoon gives us the opposite, moisture, while there is heat to make things grow. Because southeast Asia is soaked in summer by the monsoon rains, the crops can be grown and hence the people are there. In India and southeast of a line running from Calcutta to Harbin in Manchuria and in adjacent islands live half the people of the entire world Vast Siberia and all Asia west of the Indus are empty lands, with scarce 50 millions of people Most of this part of Asia is too dry or too cold for great communities, the exceptions being the grain land strip across Central Siberia and occasional small and scattered areas elsewhere With the exception of the Siberian wheat lands, it is a land in the main much like our arid west, where half the area of the United States has fewer people than some eastern states

The abundant food supply of the land of summer rain has permitted dense populations to arise and persist for thousands of years. Thus, China proper, which is only one-third as large as the United States and has half its surface covered by mountains, has nearly 300 million people according to best estimates, although there has never been a census For many generations their numbers have been so great that they could support themselves only by diligent labor, in agriculture and in household


EURASIA
Scale of Miles
ATLANTIC OCEAN
ARCTIC OCEAN
PACIFIC OCEAN
INDIAN OCEAN
ARABIAN SEA
Bay of Bengal
AFRICA
ASIA
EUROPE
Longitude East from Greenwich

industries (Figs 293, 294, 295) As a result the work habit is so thoroughly established among them that they are among the most industrious people of the world, the best of laborers By their thrift and energy and ability to live on little, they are so able to crowd out the white races in economic competition that for mere self-protection they are excluded by all white nations to whose lands they have attempted to emigrate in large numbers The average size of the Japanese farm is two and one-half acres, of the

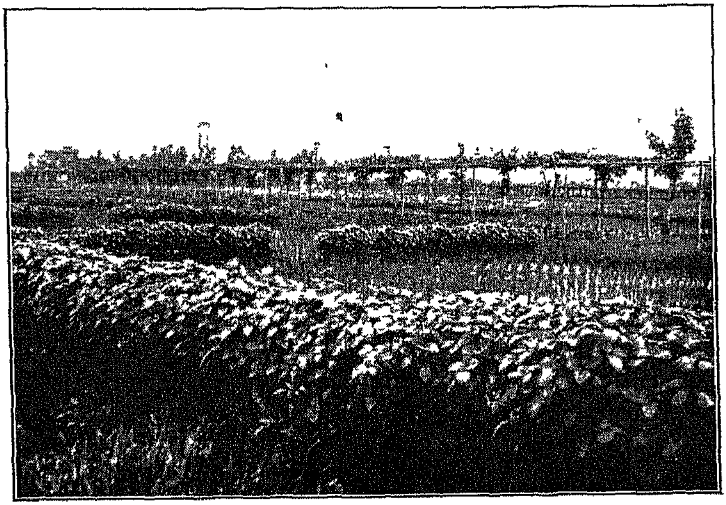


FIG 293 —Intensive agriculture in China Land completely occupied by crops, rendering effective service Soy beans on the dividing lines, rice in the paddies, pear orchards on the narrow, raised ridges (From F H King, "Farmers of Forty Centuries")

American 150 acres. There in a sentence is the argument for Japanese migration to the United States

Isolation and completeness of resource. For several thousand years China, Japan, and Korea have been a world apart. They have the great advantage over all other large groups of peoples in having the same written language The Chinese characters are to the Mongolians as the Arabic figures are to the West, everywhere understood, but pronounced differently in different localities These peoples have puzzled the West by trying to

have nothing to do with us But while they continued in their domestic system of household industry (compare United States Colonial epoch), each community was almost self-supporting. In a larger way this Mongolian region, even China alone, is almost a world in itself—an economic world

The summer rains of China stimulated agriculture, which used rich alluvial plains near the sea, while in the north were extensive deposits of fertile loess, the most indestructible of all upland soils. Reaching from the latitude of Havana to that of Newfoundland, her forests ranged from bamboo and oranges to pine and spruce, her grains from rice to wheat, corn, millet, barley, and rye In

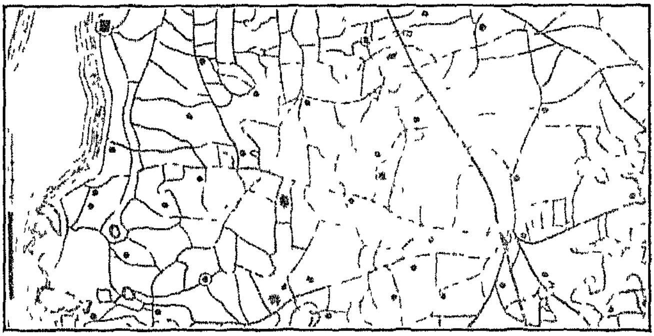


FIG. 294 —Canals in 718 square miles of Chekiang province, China Each line represents a canal (From F H King, "Farmers of Forty Centuries")

the south was cotton, in the center, silk; in the north and west, the wool and hides from the flocks that roamed the three million square miles of arid and semi-arid ranges in the provinces The mines yielded coal, iron, copper, gold, and silver The careful husbandman raised pigs and poultry in vast quantities and the fish supply of sea and river was supplemented by fish culture in which the Chinese have led the world From north to south the Grand Canal passed between the latitudes of northern Florida and Philadelphia and connected a set of inland waterways probably better and more used than those of any contemporary nation of 1800 or 1850 In mileage, these canals probably equaled those of all the rest of the world While the domestic

system of manufacturing continued in both East and West, and the East was probably doing it better than the West, the West had little for China but silver with which to pay for tea which the West desired, and which the western merchants took over the junk side in the Chinese harbors Naturally China wanted to be let alone by those who had nothing for her

All this changed when the western world entered the age of

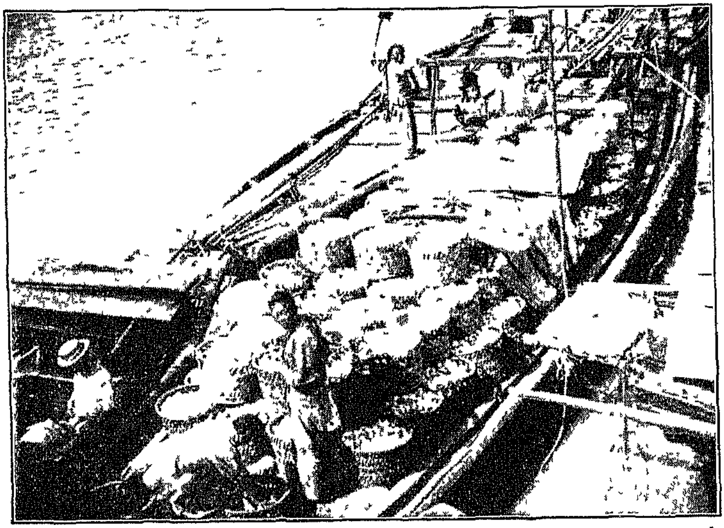


FIG 295 —Boatload of eggs on Chinese canal Evidence of intensive agricultural industry (From F H King, "Farmers of Forty Centuries")

science and began the machine epoch. The discovery of petroleum and the invention of machinery, both of which China needs, have given to that country the desire for imports, the basis for a foreign trade So complete has been China's isolation, so thoroughly has she been a world to herself, that she has had a set of prices all her own—low prices, so that the low-wage man bought low-priced commodities. A few years ago eggs cost four to five cash (two cents, U S. gold) per dozen at Yangtze ports. Eggs were five to six and two-thirds cents per dozen at Shanghai in 1911. F H King ("Farmers of Forty Centuries," p 180) found eggs in,

early April selling, near Shanghai, at 48 cents (American gold) per hundred, little chicks, $1 29 per hundred. At the same place the wage of a man per 10-hour day was 24 cents, the price of four and one-sixth dozen eggs That is the only accurate way to compare wages of different countries

Peculiar industries. In their long isolation these peoples have developed a civilization, an art and an industry distinct from anything else in the world Their great willingness to work, arising from the density of population and consequent scarcity of opportunity, has forced them to develop industries requiring great labor Of these the production of tea, silk, and rice are the most conspicuous

Tea, and factors affecting the distribution of its culture. The usual tea of commerce is the dried leaf of a tree native in the hills of Assam, one of the eastern states of British India It is quite hardy, standing a frosty climate, thriving in central China and the cotton belt of the United States, and many other places where no tea is produced The large amount of skillful hand labor required in packing and preparing tea makes it necessary that it be grown in regions of dense population with its resultant low wage. This shows why the tea industry has not been developed in the United States, although it has long been known that the tea tree thrives well over an area 100 times greater than all the tea plantations in Asia and there has often been talk of growing tea more widely A little tea of good quality has been produced near Charleston, S C., for some years, chiefly by the labor of negro children, but naturally the industry does not expand in this region of relatively high wages. It costs 15 cents a pound to pick tea in South Carolina and the laborers there have been unable to learn a certain dexterous move that pulls a leaf without destroying the bud in the axis of its stem To avoid this they pinch it off, leaving about one-third of the weight of the leaf The plucking of the leaves, especially the young leaves, is one of the hardest things a plant has to stand, hence the tea only produces adequately where an abundant moisture supply and a warm summer promote growth. Note the excellence of the monsoon for this.

Tea is widely grown in China and Japan in family gardens for home use, and is exported from both countries The tea habit of the Chinese and Japanese seems to be an attempt to make pleasant

roughly drying them in the sun, chopping them up, twigs, leaves, and all, sticking all together with rice paste, and then compressing the mass into hard bricks for shipment over the fearful passes of central Asia upon the backs of coolies, mules, camels, and yaks The greater ease of carrying this compressed form of tea accounts for its shipment by caravan into Russia at an early date

The greater part of Chinese tea is grown in central China in the Yangtze Valley, that of Japan in the southern part of the main island

Silk. Hundreds of species of insects spin cocoons in which to pass the chrysalis period of their lives. One of these insects, a moth when it is mature, but most commonly spoken of as the silkworm, makes a particularly fine cocoon, the fiber of which we call silk The process of spinning is very similar to that by which the spider makes its web, except that the silkworm winds its thread around and around itself, as a result of which it can be easily unwound if the worm is killed—as it may be by roasting—before it cuts the thread by eating a hole in the end of the cocoon to emerge as an adult moth The fibers are so fine that five are required for fine thread, and ordinary silk thread has ten to twenty fibers. Twenty-five hundred cocoons are needed to make a pound. The cocoons are soaked to loosen the fiber, the ends of several strands are placed together and the several cocoons easily unwound to make the thread of raw silk. This laborious process adds greatly to the cost of silk, which is ever the product of much labor.

The favorite and chief food of the commercial silkworm is the leaf of the white mulberry, and the Japanese mulberry orchards cover 1,000 square miles and gives rise to the chief export of the Empire. One-sixth of the Japanese families produce silk The eggs of the adult moth are carefully collected, and upon hatching, the voracious young worms are kept indoors upon trays, which must be kept clean through the weeks during which the greedy worm devours his daily portion of fresh mulberry leaves, brought in at daylight, mostly by women and children The worm can endure less cold than the mulberry tree, so the worms are kept in heated rooms in Europe and also in parts of China and Japan Humidity and temperature must be closely watched or epidemics may carry the worms to a speedy death When the worms have

and therefore serve as the basis of varnish used for vehicles Here also is gathered for shipment a large proportion of the world's rattan, the jointed stem of a creeping vine that runs for hundreds of feet through the tropic tree tops and helps to bind them together into the jungle mass Properly split it makes the cane seats of chairs

The rubber plantations. The gums are very closely allied in production to rubber, a product in which Singapore has peculiar interest A great change in rubber supply has come through the shifting of production from the isolated dying tree, to which the rubber hunter has laboriously cut his path, to the scientifically managed rubber plantations in which tens and even hundreds of thousands of rubber trees will yield an annual crop. Since the opening of this century when the automobile made rubber high-priced and threatened a rubber famine, there has been tremendous interest in rubber cultivation throughout the world The possible rubber region is very large indeed, including the equatorial rain belt which encircles the world, while the Ceará (a state in East Brazil) rubber tree has demonstrated its ability to thrive on dry, stony, tropic uplands, and the guayule bush of north Mexico, in the latitude of Texas and a climate of frost, grows and produces rubber in lands too arid for a forest or even the tilled or pastured field. Demonstrations of

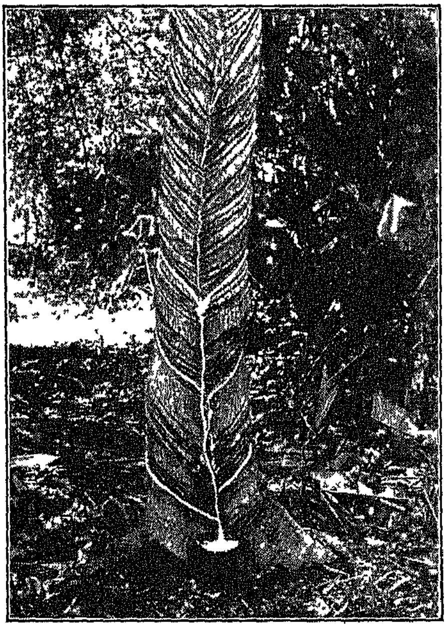


FIG 316—Rubber tree, showing method of extracting the product

rubber cultivation have been made in many lands, but the labor factor has for the time being, at least, located the great industry in Ceylon, India, Farther India, and Malaysia

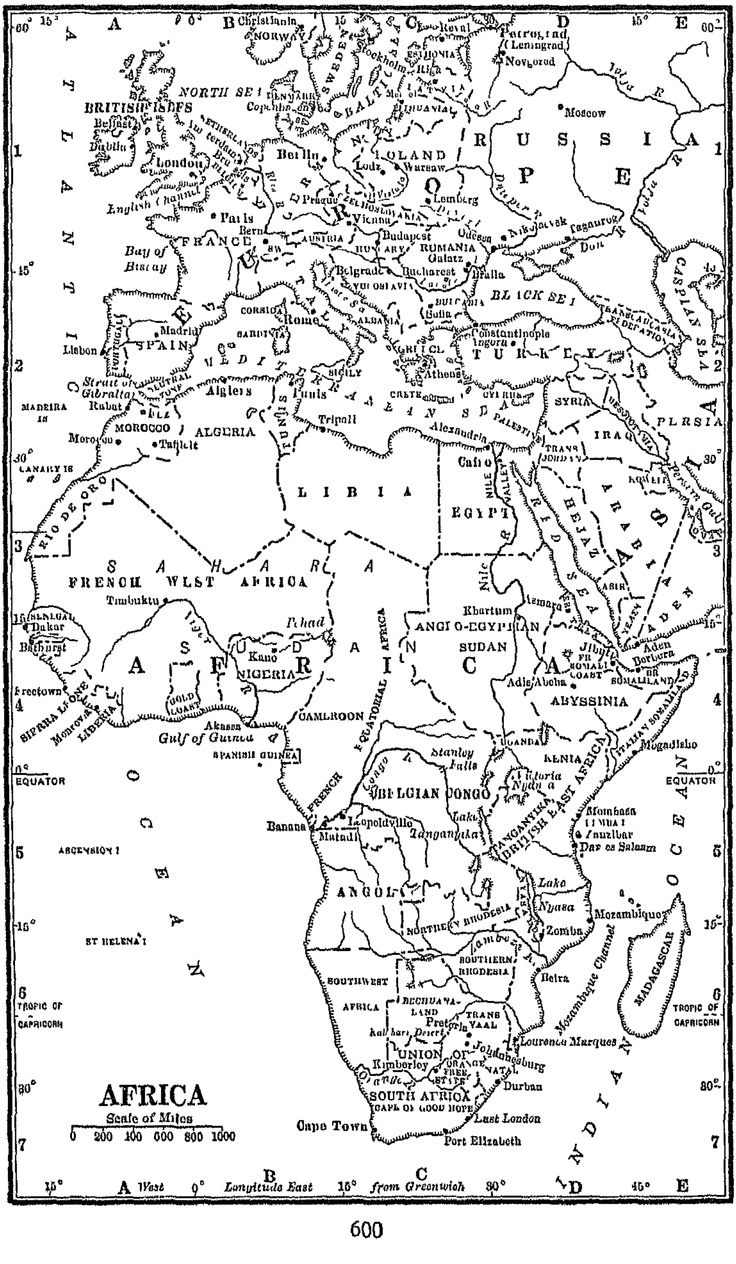
The Malay Peninsula which differs but little from equatorial lowlands everywhere, is quite as good for rubber growing as Ceylon It has a rainfall of from 100 to 200 inches, and the almost daily shower of the monsoon season in combination with the steady heat and humidity of the equatorial latitude sometimes produces in three years a Hevea rubber tree 60 feet in height. These orchards can be grown with side crops of banana, corn, or even cacao.

The labor supply of Malaya is unique The Straits Settlements (British) are a few settlements along the Straits of Malacca comprising a small fraction of the land area of the Malay Peninsula. Here the British Government has kept the ferocious natives in order, so that the Chinese, industrious, quick to seize opportunities, have gone there for the business opportunities in a climate they can stand better than Europeans. In 1921 the population (total 883,000) consisted of 8,100 Americans and Europeans, 9,000 Eurasians (half-castes), 432,000 Chinese, 94,000 natives of India, and 274,000 Malays. In the native states under British control are 300,000 more Chinese These Chinese laborers are doing the work on the rubber plantations. This makes Singapore, the metropolis of the Straits, the natural rubber metropolis in the cultivation era which arrived during the World War. Within a comparatively short distance of Singapore are the enormous labor supplies that can upon demand be furnished by the millions of China, of Java, and of India. The fare from China to Singapore was for years $2 50 per workman These coolies are good workers and are at present content with 20 to 57 cents American gold per day, depending on skill, with the worker boarding himself This kind of labor supply tropic America does not possess, and the feverish efforts of Brazil to enter upon the cultivation of rubber seem destined to poor success unless she imports Chinese laborers into her empty Amazon lands.

QUESTIONS

1 Are the forests of the Philippines with their fine woods more valuable than forests of common pine in Germany or Virginia?

2 Compare Para and Singapore as places to start a rubber export business
3 How has the high price of cow feed in Illinois affected the cocoanut industry of the Philippines?
4 Why are there more Chinese in the small Straits Settlements than in all the rest of the Malay Peninsula?
5 Does the growing of Manila hemp cultivate the work habit as does dairying?
6 Explain how tariff walls may keep natural industries from growing.
7 Compare the prospects of an oil famine and a rubber famine


AFRICA
Scale of Miles
0 200 400 600 800 1000
West 0° Longitude East 15° from Greenwich 30°
ATLANTIC OCEAN
INDIAN OCEAN
EUROPE
RUSSIA
ASIA
BRITISH ISLES
NORTH SEA
BALTIC
NORWAY
SWEDEN
ESTHONIA
LITHUANIA
POLAND
FRANCE
SPAIN
PORTUGAL
ITALY
AUSTRIA
HUNGARY
RUMANIA
JUGOSLAVIA
ALBANIA
BULGARIA
GREECE
TURKEY
SYRIA
PALESTINE
TRANS JORDANIA
IRAQ
PERSIA
ARABIA
HEJAZ
YEMEN
ADEN
BLACK SEA
CASPIAN SEA
MEDITERRANEAN SEA
RED SEA
Persian Gulf
Bay of Biscay
English Channel
Strait of Gibraltar
London
Dublin
Paris
Bern
Berlin
Prague
Vienna
Budapest
Warsaw
Lodz
Lemberg
Riga
Reval
Petrograd (Leningrad)
Novgorod
Moscow
Odessa
Nikolaevsk
Bucharest
Galatz
Braila
Belgrade
Sofia
Constantinople
Angora
Athens
Rome
Madrid
Lisbon
CORSICA
SARDINIA
SICILY
CRETE
CYPRUS
MADEIRA IS
CANARY IS
MOROCCO
Rabat
Fez
Morocco
Tafilelt
ALGERIA
Algiers
TUNIS
Tunis
Tripoli
LIBIA
EGYPT
Alexandria
Cairo
NILE VALLEY
Nile
SAHARA
RIO DE ORO
FRENCH WEST AFRICA
Timbuktu
SENEGAL
Dakar
Bathurst
Freetown
SIERRA LEONE
Monrovia
LIBERIA
GOLD COAST
NIGERIA
Kano
Akassa
Gulf of Guinea
Tchad
Niger
CAMEROON
SPANISH GUINEA
FRENCH EQUATORIAL AFRICA
ANGLO-EGYPTIAN SUDAN
Khartum
ABYSSINIA
Adis Abeba
FR SOMALI COAST
Jibuti
BR SOMALILAND
Berbera
Aden
ITALIAN SOMALILAND
Mogadisho
UGANDA
KENIA
BRITISH EAST AFRICA
Victoria Nyanza
Stanley Falls
BELGIAN CONGO
Congo R.
Leopoldville
Matadi
Banana
Lake Tanganyika
TANGANYIKA
Mombasa
Zanzibar
Dar es Salaam
ANGOLA
NORTHERN RHODESIA
SOUTHERN RHODESIA
Lake Nyasa
Zomba
Zambezi R.
Beira
Mozambique
Mozambique Channel
MADAGASCAR
SOUTHWEST AFRICA
BECHUANALAND
Kalahari Desert
TRANSVAAL
Pretoria
Johannesburg
Lourenço Marques
ORANGE FREE STATE
NATAL
Durban
Kimberley
Orange R.
UNION OF SOUTH AFRICA
CAPE OF GOOD HOPE
Cape Town
East London
Port Elizabeth
ASCENSION I
ST HELENA I
EQUATOR
TROPIC OF CAPRICORN

CHAPTER XXXVIII

TROPIC AFRICA

Right across the center of Africa runs the equator, with its accompanying zone of calms and rains and resulting jungle—a great equatorial forest like that of South America. As this Doldrum zone of heavy rains moves north and south a few degrees with the passage of the sun, it gives the annual floods of the Nile which have supported so many dynasties and so many millions of subjects in Eygpt In the southward swing it sends great waters over the falls of the Zambezi

To the north and south of the Doldrums are the zones of the trade winds which here blow from over the land and are therefore desert-making winds resulting in the Sahara and Kalahari Deserts Between these deserts and the forests are transition regions of plains or steppes with grass and occasional trees, and a climate far more wholesome than that of the humid jungle

For a long time Europe was content to call Central Africa the Dark Continent and let it alone Approach was difficult, for the coasts are swampy and unhealthy, and the rivers come down from the plateau with many falls making their ascent impossible The equatorial climate is fatal to most beasts of burden, so man was thrown back on his own muscle in an enervating climate (Fig 317). Then, late in the nineteenth century, the fever of colonial possession suddenly struck Europe. Africa was partitioned off, and railroads and steamboats have pierced the Dark Continent with surprising speed. They have often been built by colonizing governments in advance of any adequate economic demand Commerce is rising rapidly, but the natives, of whom there are many millions, do not have many needs or many industries The most valuable products of Africa are often the minerals, exploited by the white managers from far-off countries The native exports have rarely even got down to agriculture, being composed almost exclusively of the forest products of ivory, rubber, palm nuts, and palm oil, some cacao, and cocoanuts Life has been too easy

to compel the development of industries in the modern sense. The ease of banana production should be emphasized in its effect on tropical life In the Congo Basin and other humid parts of central Africa, where the climate is so bad for the white man, the

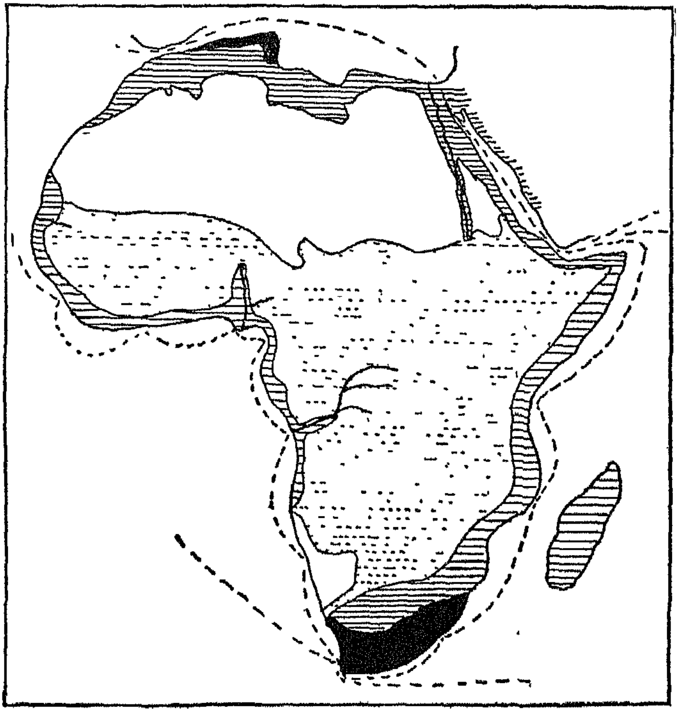


Fig 317 —The trade zones of Africa (After Robt M Brown)

Regions of large commerce
Regions of important commerce
Regions commercially undeveloped
Desert or unproductive regions
Steamer routes

nutritious banana is said to be the main article of diet for many, probably scores of millions, of the negro race. It merely replaces bread and the potato of the north European peasant, and the rice of the southern Chinese.

Some people think that the Africans are not agriculturists. Nothing is farther from the facts. The percentage of farmers in Africa is double that in the United States. It is nearly always primitive agriculture, patch farming we might call it. A clearing out of small trees and deadening of big ones makes room for a garden containing bananas, cassava, upland rice, corn, pumpkins, tomatoes, and other vegetables which grow among the dead trees. It is all hand work. No plow. No food for animals is grown. Man, or rather woman, grows crops for human food. The wild oil palm furnishes a butter substitute. In two or three seasons the jungle begins to crowd and the garden is moved and the jungle or the grass, depending on location, reclaims its own.

It is plain that these people eat little meat. They have no source for it other than game. Sometimes the carriers of the pack trains will squat over a fire at evening and stir and bake a cake of coarse corn meal and water, and thus nourished take up their burden again the next day and trudge on.

On the grass lands cattle are often kept and meat and milk are common articles of diet.

On the drier sections of the grass lands where they merge into the desert we find people who must be nomads and who have flocks for their chief wealth.

In the edges of the Kalahari there are a few tribes who make their living by hunting—animals, birds, grubs, roots and wild fruits near the water courses. For these people the water hole is a great asset. There they can ambush game that must come to drink. The people who live by this uncertain manner are naturally few in number.

The Belgian Congo. The great heart of the forest region, shows how little this home supply agriculture has to do with commerce. Of the exports copper makes up one-half, palm nuts one-fourth, and smaller amounts of gold, ivory, palm oil, copal, and rubber. (Ten years ago rubber had half of the value.) They import cottons, clothing, provisions, machinery, steamers, arms, and ammunition.

In the southeastern part of Belgian Congo is the Katanga district, so rich in copper that it is an object of railroad building from four directions. It has already produced over 50,000 tons of metal in a single year (1923). The copper deposits are so near

the surface that mining is done in the open with pick and shovel or by steam shovel. The main cost of production is the roundabout and expensive railway line to the sea coast Katanga is already ranked as one of the world's leading copper producers

The Congo River route. The Congo River is at present the longest and the greatest central African highway About a score of steamers ply between the seaport of Banana at the mouth, and Matadi, less than 100 miles inland, where a 250-mile railway connect with the steamers of Leopoldville, on Stanley Pool above the numerous falls The commercial changes of the new Africa can be easily inferred from the effects of the railroad from Matadi to Leopoldville The journey used to require 20 days, with great loss of life The freight rate was £2 (nearly ten dollars) per load (human carrier) of 65 to 75 pounds, about $250 per ton. The journey now takes two days and the freight rate is $3 per ton. From Leopoldville eastward the Congo is navigated for 1,200 miles to Stanley Falls on the equator. Here another railroad connects with several hundred miles of navigable waterway on the upper river, giving steam service 2,250 miles from the sea Several branches are also navigable Trains, with ferry across Tanganyika, now connect the upper Congo and the Indian Ocean Everywhere there is great similarity of imports, first cotton cloth, then hardware, trinkets, and varying amounts of machinery and equipment goods, depending on the new enterprises of the region in question

The west coast of Africa, so deadly to white men, has an increasing trade. The Gold Coast, under the leadership of white men mainly from Great Britain, has developed a new and valuable tree crop agriculture. From less than 6,000 tons in 1905, the output of the cacao plantations has risen to 160,000 tons in 1922, with an export value of $28,000,000. The Gold Coast now produces from one-third to one-half of the world's cacao crop Cacao production is also important on the islands of Sao Thome (or St Thomas) and Principe (or Prince's Island), lying under the equator in the Gulf of Guinea. While they have less than 64,000 people (of whom 97 per cent are negroes) and have an area of but 360 square miles, they have the cacao climate and a fertile volcanic soil. This tiny Portuguese Colony has at times outstripped Ecuador and all other cacao-producing countries. This is not a

measure of superiority of resources It is a result of the fact that slavery still exists there and the task master can make the native work.

Gambia has a different sort of agricultural export, $4,000,000 worth of peanuts.

One of the most interesting of African products is the oil-yielding palm nut—exported from the west coast, between the upper part of the Gulf of Guinea and Fernando Po, from the east coast between Zanzibar and Pemba, near the Tropic of Capricorn,

FIG 318 —Long-horned cattle of the Savannah lands of Africa—one of the meat reserves of the more high priced future (H L Shantz, United States Dept Agr)

and also from the shores of the African lakes The native climbs the 30-foot palm tree and cuts off its head of fruit, as big as a basket. The many small fruits are boiled, thrown into a kettle of water, and tramped by bare feet to crush out the oil, which is skimmed from the surface of the water. This is refined by further boiling, and used throughout much of Africa as a choice morsel of food, a substitute for the olive oil of Europe and the butter of America. It is also the chief money crop of west African countries and is one of the important articles of freight for the many steamers that skirt the African coast The kernel of the seed is also quite

largely exported for the manufacture of oil in European ports At present it is used for soap, but we shall probably soon be eating it and calling it butter This tree is a good example of tropic fecundity, and an example of the easy tree agriculture of which the tropics have such great possibilities

In the British colony of Nigeria (about 332,000 square miles and 18 million people, of whom 2,800 are Europeans), palm products make up over $30,000,00 of the $40,000,000 worth of exports Its trade, however, promises to increase because of the extensive commercial equipments now in progress. Akassa, the chief port, has several hundred miles of the navigable lower Niger adjacent to it, with government steamers and barges upon it, and, from the head of navigation, the government has completed a 400-mile narrow gauge railroad to Kano, a caravan trade center and commercial metropolis in the latitude of Lake Tchad in the Sudan, 900 miles (4 days) from the sea This is one of the least known but apparently the most populous and promising parts of tropic Africa The latest geographers report cities of 60,000 to 100,000 people, who are, for Africa, industrious, and the climate and the country are suited to live stock. It is the transition region (grassland) between the desert to the north and the jungle to the south, and is said to be good for cotton growing It is Africa's land of promise, with a possible cotton area in Nigeria alone five-sixths as large as that of the United States

The French have recently established a rail and steamer route via the Senegal and upper Niger Rivers from Dakar on the west coast to Timbuktu. It seems to spoil romance to go to Timbuktu by steam, but it is a great improvement of the freight rate.

East central Africa is a land of less population, but because of its greater aridity and elevation it has some possibility of becoming in part a white man's land. We see the aridity shown in a soda lake at Megadi where the evaporation of the water has left a soda deposit covering 30 square miles and of almost incalculable amount. An output of 500 tons and later of 1,000 tons per day is expected. A special branch railroad, 95 miles long, has been built to connect it with the British line that goes from Mombasa to Lake Victoria.

The white man's land is limited by the plateaus of Kenya Colony, where five million sheep are now reported, most of them of the native woolless variety. Experiments at breeding up from these

hardy sheep are succeeding The problem of producing the breeds of domestic animals before settlement can take place, shows the great handicap of Africa in comparison to the settlement of the United States. This securing of domestic animals is almost as important for the transplanting of civilization to Africa as it was for the first origins of civilization. It would seem that the moderns, if possessed of any spark of appreciation for resources, should

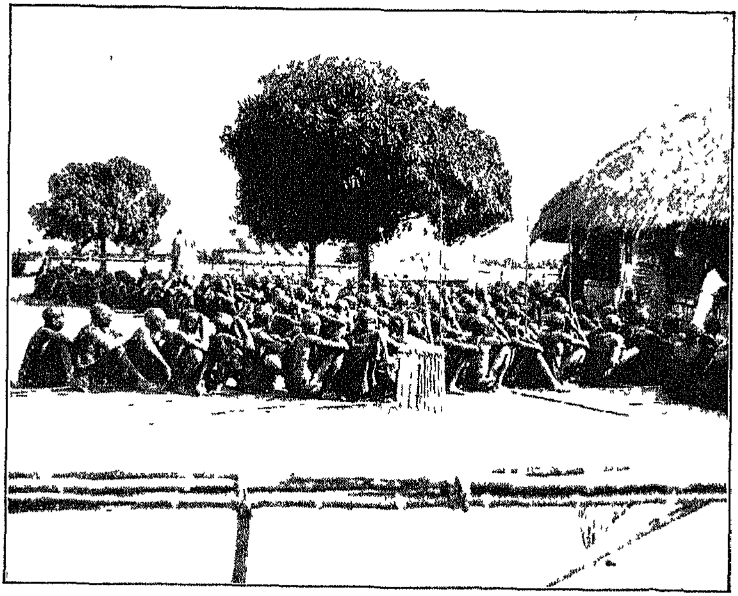


FIG 319—A Central African freight train (of carriers) waiting to be loaded (H L Shantz, United States Dept Agr)

duplicate the achievements of the ancients, redomesticate the elephant and give to central Africa the most powerful of all beasts of burden where it now has the least efficient—man (Fig 319) We ought to be able to do as much as the Carthagenian general Hannibal did more than two thousand years ago There are doubtless other native animals worthy of domestication

Parts of Africa have some hope of a beast of burden through the probable fitness of a new hybrid, the Zulebra, a cross between the

horse and zebra—an equine that resembles the horse quite as much as does the ass The African tsetse fly kills all the domestic equines, but four species of zebra are native and immune—possible bases for an efficient new work animal for which several million square miles of middle Africa are sadly in need

The Cape to Cairo railway, long a dream of Cecil Rhodes, the empire builder, is almost completed, if steamer links be included, and a good many days of marching on trails It took eight weeks to complete the journey in 1922 It already extends with an unbroken railway line 3,000 miles long from the Cape up to a point beyond the boundary of Belgian Congo The northern half is furnished by the Egyptian railroads and Nile steamers If it is ever completed it will have no through traffic, but will merely serve as a feeder to coast lines already built, as that from Mombasa or the one in Tanganyika territory (once German East Africa)

Commercial agriculture, settlement, and new industries come slowly in tropic Africa, but mineral deposits give quick traffic A copper deposit in central Africa, known as the Star of Congo mine, affords an interesting example Before the completion of the railroad to it, from Beira (1911), mining work was already begun, so that 1,000 tons of copper per month could be extracted as soon as the railroad permitted the erection of the machinery and a yield of 5,000 tons of copper per month was soon possible.

Central Africa, like the rest of the tropics, being nearly devoid of coal, has a compensating resource in the enormous water-power which its districts of heavy rainfall afford Africa, a vast plateau, has rivers tumbling down to the sea in many cataracts, those of the Congo in west Africa surpassing Niagara a dozen fold French and Belgian Congo have almost the unbelievable total of 135 million horse-power, while Niagara has but six and all North America but 62 million. Engineers are already discussing the carriage of power from the falls of the Zambesi, 700 miles to the gold mines of Johannesburg in the Transvaal, and the diamond mines at Kimberley in Orange River Colony

Because of the tropic climate there is small prospect that this power will be used for anything but extractive work and the heaviest power-using industries, like the manufacture of nitrates, unless we get some new kind of transmission. Thus Africa promises to stay in a condition of increasing trade because her development

will be along the line of extractive industries requiring exchange with the manufacturing countries Her development also will be strictly under foreign guidance, as it now is Thus nearly all the commerce and much of the industry of the east coast is carried on by a few thousand Hindoos They have even transported thither an oriental spice industry, the production of cloves, of which Zanzibar is a great center.

"Formerly this spice was imported to the west in great quantities from the Moluccas, but now the trade has passed almost entirely to Zanzibar and Pemba which provide the requisite conditions for clove cultivation, viz, a dense population and a high temperature all the year around, rain at very frequent intervals, and heavy dew A month of dry weather with no dew would probably kill the stoutest tree" "Pemba The Spice Island of Zanzibar" By Capt J E E Craster

The grass lands that surround the equatorial forest on the north side and also on the highland east of the great African lakes is occupied by cattle-keeping natives but the time has not yet come for their cattle to go to the European market (Fig. 318).

QUESTIONS

1. What part of tropic Africa promises to have the best cotton zone? What nation has made it accessible?

2 What surface and climatic features delayed the opening up of Central Africa?

3 Explain how the shifting Doldrum rains make seasonal flood on the Nile and fairly even flow on the Congo?

4 With what temperate zone products does the African palm nut compete?

5 What industries make the heaviest freight traffic in tropic Africa?

6 How were the ancients ahead of the moderns in the domestic animal question?

7 Suppose France and Belgium had the water-power of the French and Belgian Congo What changes would you expect?

CHAPTER XXXIX

UNION OF SOUTH AFRICA

The part of Africa beyond the Tropic of Capricorn has the misfortune not to extend far enough south to get into the latitude of heavy rains produced by the prevailing westerlies As a result it is largely a land of desert, made much worse by the mountains of Natal which shut off the southeast trade winds and limit the district of heavy trade wind rain to an eastern coast strip of relatively small area The exports are therefore limited to minerals and the produce of arid agriculture, although the eastern coast is fitted by nature for the production of cane sugar, coffee, tea, and other tropic and subtropic agriculture of which there is some development with the aid of East Indian coolies. Its chief object, however, is to supply the home market

We see the aridity showing in an export of mohair exceeding that from Asia Minor, the home of the Angora goat, which, in Africa, pastures on the arid approaches to the Kalahari Desert The better pastures on the great plains of the interior are given over to sheep and cattle ranches, but the total number of cattle in the Union of South Africa, nine million in 1924, was only slightly greater than in the small country of Uruguay. In the total number of sheep and goats South Africa equals the United States. In Matabeleland, Rhodesia, north of the Transvaal border, a large grant of land has been made to a London company, which built dipping tanks (for disinfecting live animals and removing vermin), dug wells, and stocked its ranch with cattle Later it is planned to build a meat-extract plant. The location, as far from the Southern Sea as Chicago is from the Atlantic, and with no home market, is a natural one for the manufacture of so concentrated a product

In the seventeenth century when Holland was the great maritime, financial, and commercial power of Europe, as England was in the nineteenth, the Dutch settled South Africa as a provisioning station for their East India ships. Later, England took the Cape and the Dutch went inland (trekked) and now the region has the two races

mixed and under English rule. Except in the extreme South the black population outnumbers the white, about four to one, and practically all the work of the region is performed by these natives

The Union of South Africa was formed in 1909 by the mutual consent of the self-governing colonies of Cape Colony, Natal, the Transvaal, and Orange River Colony. It is a pastoral and mining region, resembling some parts of the western United States and having an area a little larger than Texas, New Mexico, and Arizona. This region is in the early stages of ranching and agriculture The railroads, which are so necessary, are building in many directions to develop a constantly enlarging frontier. The backbone of this railway system, the trunk line running north from Cape Town, has five side lines connecting with the ocean at Port Elizabeth, East London, Durban, Lourenço Marquez, and Beira

Grain crops. South Africa is a land of limited agricultural possibilities. Wheat is grown successfully but the aridity is too great for South Africa to ever become an exporter of wheat, a condition found in no other new land in a temperate zone. For corn, the staple crop of the Union, the soil, climate, and rainfall are partially favorable over wide areas. In 1904 the corn crop amounted to only 13 million bushels but by 1923 it had increased to 50 million and South Africa entered the world's cereal-supplying ranks, with an export of corn which seems likely to continue in the future Barley, oats, and potatoes are also successfully raised Droughts are the greatest single obstacle in the way of increasing food production, hail is also an ever-present and frequent danger. The future agriculture of the Afrikanders may be expected to supply an ever-growing amount of the food-stuffs needed locally, but it is doubtful whether the region will ever get much beyond local self-sufficiency

Fruit growing. Southwestern Cape Colony, having the Mediterranean type of climate (see chapter on Fruits), is admirably fitted for fruit production, and has two advantages over any North Temperate zone region. One advantage is a very mild winter, because there is no land from which cold waves can rush in. The other advantage is the ripening season, which permits the shipping of fresh grapes, plums, and peaches to London and New York in March and April, the season when fresh fruits command the highest prices in the north temperate zone. Oranges

and lemons are unusually successful As in California, South African fruit growing, which is largely centered in the western part of Cape Province, is a matter of irrigation The natural resources of the region are excellent save for limited water supply, and the fruit raised is of such high quality that England took over one million boxes during the 1923 season

Ostrich farming. South Africa has developed one new agricultural industry—the domestication of the ostrich. It has almost a monopoly of the export of the plumes This is an interesting example of a new domestic animal and a new industry The plume-producing bird is a native of semi-arid Africa, being found over most of the Sudan and large areas in South Africa The British in South Africa found that when inclosed by a strong fence and supplied with suitable food of grain and good grass the ostrich will thrive about as well in domestication as the sheep In 40 years the Afrikanders have reduced ostrich keeping to a science, established systems of registry for pure-bred birds and improved them to the point where $5,000 has been paid for a single bird for breeding purposes. The number of tame birds in the fields of Cape Colony farmers is 268,000 (1922), the finest feathers sell as high as $200 per pound, and the feather export is $2,000,000 (Fig 320)

The ostrich business was at its best in 1913, when there were three times as many birds in Cape Province Changes in styles and the lessened buying power of post-war Europe have resulted in a depression from which ostrich growing has not recovered.

Gold and diamonds. The commerce of South Africa is predominantly dependent upon the gold and diamond industries The gold output of Transvaal and Rhodesia far exceeds that of any other country ($157,000,000 in 1922, one-half of world's production) The producing district of the Transvaal, known as the Rand, is a long range of low hills, the leading gold district of the world, with Johannesburg as its chief center. It is in a semi-arid country like New Mexico or Arizona, where other industries are few and communities of hundreds of thousands of people must live by mining alone The deposits are of great depth, and the companies can therefore plan to work for many years It is the practice to bring men from great distances to work in these mines on time contracts. They come from interior Africa and from

China, but the Chinese must be taken back to China by the mining companies when these contracts expire.

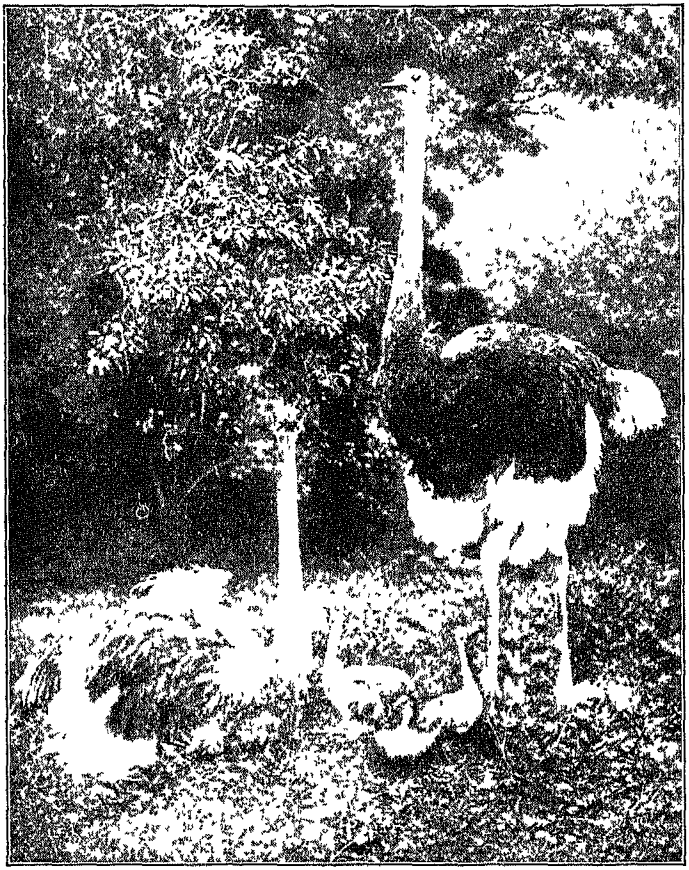


FIG 320 —Ostriches—the last important addition to our domestic animals (Reproduced by permission of the Philadelphia Commercial Museum.)

In the diamond output of the world Transvaal is even more predominant than in gold Brazil was for a long time the leading diamond-producing country in the world The Brazilian dia-

monds were found upon the interior plateaus of the state of Minas Geraes, near Diamantina, in a sparsely settled region where the diamonds had been left in the beds of streams by the same process which leaves gold in the stream, namely, the washing down from the mother lode. During the last quarter of the nineteenth century, South Africa vastly outdistanced Brazil, because of the discovery of several so-called diamond pipes in the vicinity of Kimberly, in the Transvaal. These deposits are believed to be the cores of old volcanoes with diamonds imbedded in the lava, now existing as a hard formation known as blue clay or diamond clay. The washing of the clay from these old volcanic necks produced diamonds so much more cheaply than the hunters of Brazil can find them that for many years South Africa has virtually supplied the world. Nearly all the product is furnished by two companies, which maintain one of the tightest trusts in the world.

Foreign trade. British South Africa is served by several lines of splendid steamers working in unison and giving service from Liverpool, New York, London, Southampton, and the Continent. The liners engaged in the South African trade pay no heed whatever to all the rest of Africa, but steam directly from Europe and America to Cape Town and usually skirt the coast to Lourenço Marquez, stopping at Port Elizabeth, East London, and Durban (Fig. 321).

The traffic of South Africa is a very peculiar one in the world's trade. Regions of sparse population and comparatively recent settlement are usually producers of large quantities of raw material and consumers of manufactures, which comprise a much smaller tonnage. Such has been the commercial history of practically every country in the New World, but, owing to the scanty rainfall, which precludes extensive agriculture in South Africa, and the great predominance of gold and diamond mining among the industries there, South Africa imports lumber, grain, flour, machinery, and general manufactures, and pays for them in such valuable commodities as gold, diamonds, ostrich feathers, wool, mohair, hides, and skins. The old saying that "good goods come in small packages" here holds true, so that a vessel carrying a cargo to South Africa faces the almost inevitable prospect of going away practically empty. The Cape is therefore a scattering point for vessels in ballast, seeking freight.

The future of the American trade with South Africa and Australasia is particularly bright, because these British colonies are in the same stage of industrial development as parts of the

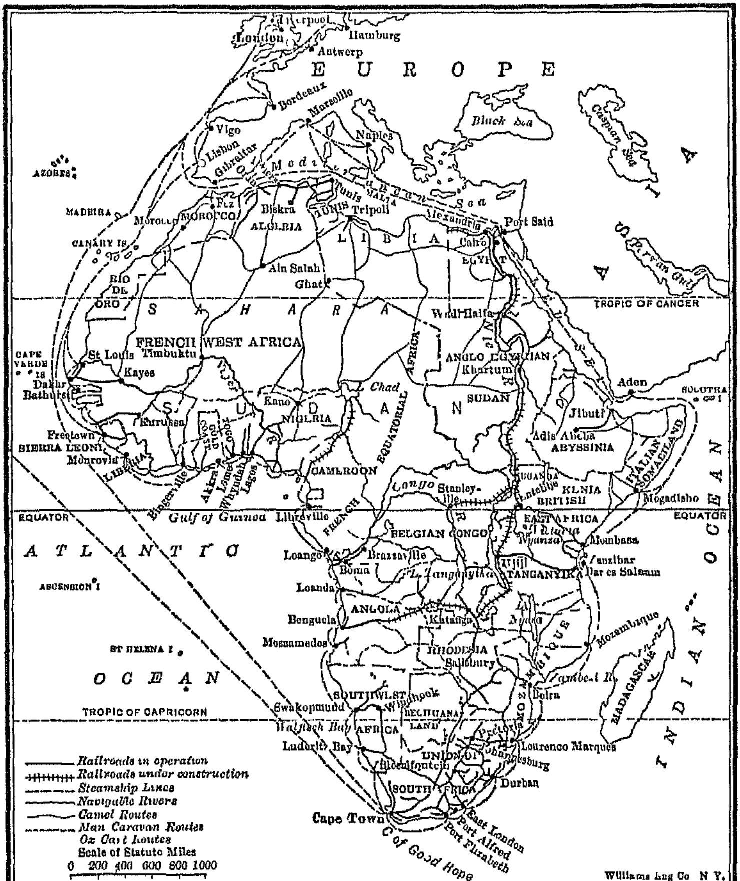


FIG 321 —Trade routes of Africa

American West. We have had experience with their kind of physical problems, our agricultural machinery is adapted to their kind of land, as our mining machinery is adapted to their mines,

and there is every reason to expect a continued and increasing trade in American machinery and supplies for the development of these new lands, while our mills and tanneries are increasingly dependent upon their wool, hides, and skins.

Questions

1 Give a climatic explanation of the fact that South Africa imports more tons of freight than she exports, the influence of the mining industry on the same fact

2 What advantages and disadvantages does South Africa have for the development of the fruit and vine industries?

3 How does the climate cause an export of mohair rather than pork or beef?

4 How have the South Africans established a new animal industry?

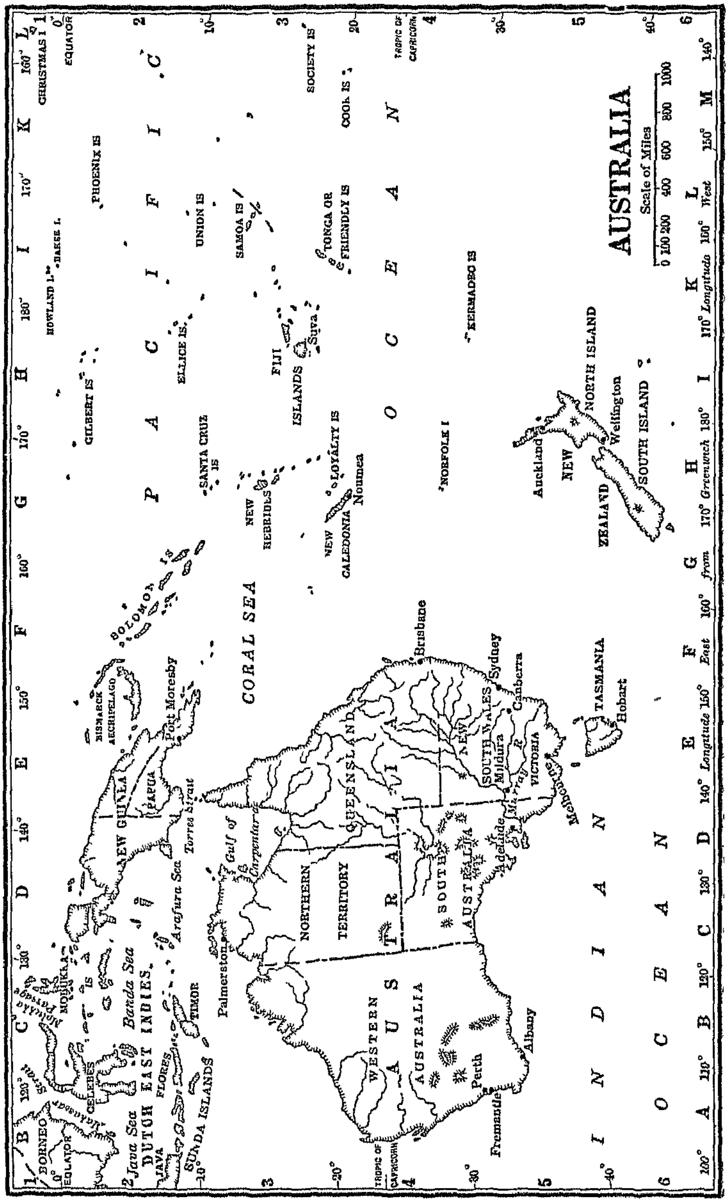
5 Why is the future of the ostrich industry harder to predict than the future of the sheep industry?

CHAPTER XL

AUSTRALASIA AND POLYNESIA

Australia has many points of resemblance to South Africa. It has the same latitude, the same trade wind desert, just missing the good rain-bearing west winds, and it even has a north and south mountain range along the east coast to shut off the winds which have in similar latitudes made such a fine country of Uruguay and part of Argentina. Fortunately this rain-checking mountain range is not so high as it is in Natal, thus permitting large areas to get enough rainfall to produce some wheat and pastures, although most of the continent is desert (Figs 322a and 322b.) Australia differs from South Africa in having almost entirely a white population. They are largely British.

The animal industries. Australia has long been known as the greatest of sheep countries and the leader of wool exporters It is about as large as the United States, but the mountain barrier parallel to the eastern coast shuts off from the interior most of the moist wind brought by the southeast trade winds, leaving only a narrow plain along the coast fit for corn and other agricultural crops requiring much moisture Between the mountains and the grassless desert which occupies the central and western part of the continent are some of the finest sheep ranges in the world The railroads that connect the ranches with the eastern ports reach almost to the desert and all the land that has any value has for some decades been occupied by the sheep flocks. (Fig. 323) Australia is unfortunate in the arid nature of much of her territory and also in the irregular character of the scanty rainfall. Droughts sometimes last for long periods, cutting off both grass and water so that the sheep perish by millions, as in the period 1894 to 1898 when continued drought reduced the sheep flocks from 110 million to 84 million The great dependence of the flocks upon rainfall and rainfall fluctuations is shown by the observations of a scientist who says that with 10 inches of rainfall per year, an Australian plain will support ten sheep per square mile; with


AUSTRALIA
Scale of Miles
0 100 200 400 600 800 1000
P A C I F I C
O C E A N
I N D I A N
O C E A N
CORAL SEA
Java Sea
Banda Sea
Arafura Sea
Torres Strait
Gulf of Carpentaria
Macassar Str.
Molukka Passage
DUTCH EAST INDIES
BORNEO
CELEBES
JAVA
FLORES
TIMOR
SUNDA ISLANDS
MOLUKKA IS
NEW GUINEA
PAPUA
Port Moresby
BISMARCK ARCHIPELAGO
SOLOMON IS
NEW HEBRIDES
SANTA CRUZ IS
NEW CALEDONIA
Noumea
LOYALTY IS
FIJI ISLANDS
Suva
ELLICE IS
GILBERT IS
HOWLAND I.
BAKER I.
PHOENIX IS
UNION IS
SAMOA IS
TONGA OR FRIENDLY IS
COOK IS
SOCIETY IS
CHRISTMAS I
EQUATOR
TROPIC OF CAPRICORN
KERMADEC IS
NORFOLK I
NEW ZEALAND
NORTH ISLAND
SOUTH ISLAND
Auckland
Wellington
A U S T R A L I A
WESTERN AUSTRALIA
NORTHERN TERRITORY
QUEENSLAND
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
TASMANIA
Hobart
Palmerston
Perth
Fremantle
Albany
Adelaide
Mildura
Murray R.
Melbourne
Canberra
Sydney
Brisbane
100° Longitude 110° East 120° 130° 140° from 150° Greenwich 160° 170° 180° 170° West 160° 150° 140°
A B C D E F G H I K L M
0° 10° 20° 30° 40°

13 inches of rain, twenty sheep, and with 20 inches of rain, seventy sheep With less than 10 inches of rainfall, the land is of no value even for pasturage The peril of the sheep is seen in the fact that in different years the rain may be any one of those amounts.

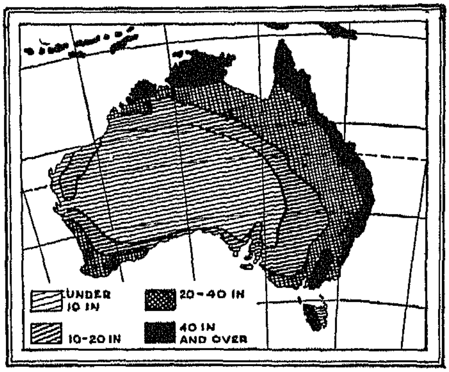


FIG 322a —Mean annual rainfall for Australia (Diercke.)

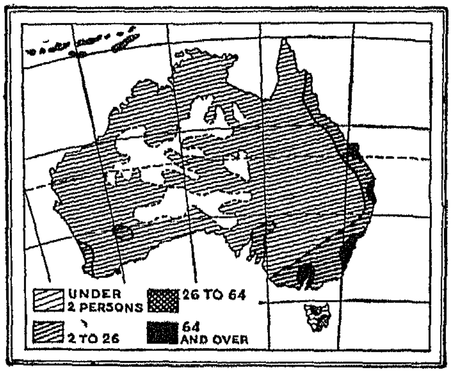


FIG 322b —Map showing density of population per square mile in Australia (Lyde) (From Salisbury, Barrows, and Tower) Australia is almost an empty shell

New South Wales possesses nearly half the sheep of Australia, while Queensland, further north (partly in the tropics), has one-quarter of them. Queensland has more rain and more abundant forage, so she leads in cattle as well, since they can stand heat and

moisture better than sheep, and require better pasture South of New South Wales is Victoria, which lies far enough from the equator to be in the edges of the zone of prevailing westerly winds and gets more rain than New South Wales It produces large numbers of both sheep and cattle Because of the superiority of the Victorian pasture in a cool climate the farmers have enough grass to keep cows and make butter, of which much more is exported than is exported from the United States (see table of dairy prod-

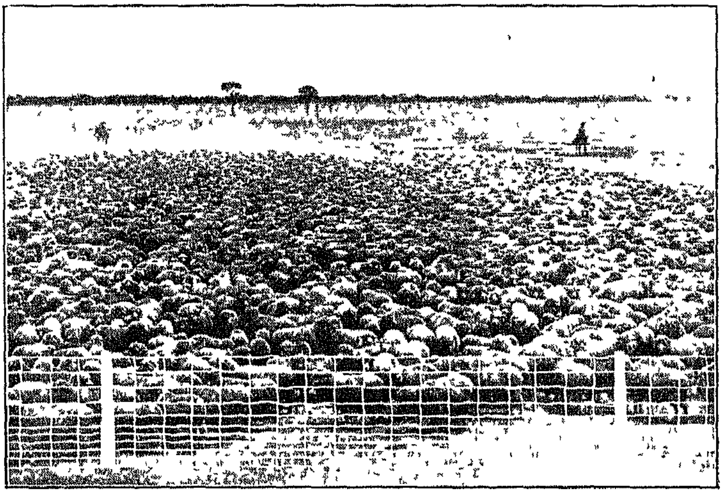


FIG 323.—A flock of sheep in Australia. The fence is American.

ucts) The market for the butter, as for the frozen beef of Queensland and frozen mutton of New South Wales, is almost entirely in the mother country, Great Britain.

The large flocks of Australia (Fig 323), like those of other southern hemisphere lands, help to give the South Temperate Zone 40 per cent of the world's sheep, although it has but one and one-half per cent of the population In Australia the sparse population of about two per square mile has, for each 100 people, 300 horses and cattle and 14 sheep. These figures show why meat and other animal products make up such a large proportion of the exports of these sparsely peopled south temperate zone countries

Since swine are meat animals of grain-growing lands, as the sheep is of grass-growing lands, pastoral Australia has 100 sheep to one hog, while Iowa, a great corn state, has eleven hogs to one sheep. The production of sheep just suits these lands, but the fact that some of these lands are hot, and do not naturally suit the sheep, is another illustration of an industry in a place that is not best suited to it The sheep with his warm coat is equipped for cold climates, the fleece degenerates in hot lands, the wool entirely disappearing in the tropics, leaving only the hair coat, of which all sheep possess a little. In Australia, the tendency to degeneration because of heat has been overcome by the constant importation of fresh breeding stock from England, Vermont, and other localities where the sheep is at his best.

New Zealand, farther south than Australia, with the good rainfall of the prevailing westerlies and an open winter, is an excellent sheep country, and is largely given over to that industry

Some of the mountain pastures upon the western coast of New Zealand, very wet from exposure to the sea winds, have such splendid grass that they will support five sheep per acre throughout the year These mountains make the eastern side of that island drier, and thus cause the Canterbury plain on the east, the best stretch of arable land on the islands, to be largely used for wheat growing, but owing to the sparse population, less than a million people in a good grazing territory as large as New York, New Jersey and Pennsylvania, agriculture cannot be very much developed and the 22 million sheep and three million cattle are the chief wealth of the country. The good pasture and regular food supply of New Zealand causes the frozen mutton of that country to be considered the best that is imported into England The sheep are often fattened by being turned into large fields of turnips from which they first eat the tops and then the entire root, and mutton can be produced at a very low cost, proved by the fact that it competes with home-grown mutton in the United States, at times.

When the Australasian sheep ranches were first established in the middle of the nineteenth century, there was no thought of selling meat Wool, skins, tallow, and bones were the products. In the decade between 1880 and 1890, the perfection of cold storage and refrigeration suddenly caused a demand for mutton at Buenos

Aires, at Wellington, New Zealand, at Melbourne and Sydney, Australia, as well as at Chicago, Kansas City, and Omaha The rising price of meat since 1900 has emphasized that demand and made the carcass more valuable by far than the fleece.

The merino sheep, with his excellent fleece, had no plump fat carcass, while the mutton-loving English had carefully bred and selected the Lincolnshire and the Southdown and other breeds for the ability to grow large and fat and make fine mutton, regardless of their coarse and meager wool. The refrigerator ship suddenly made the big, meat-producing sheep more valuable in Argentina, Montana, and Australia than was the fine fleeced little merino As a result, the sheep breeders at once began cross breeding their flocks for mutton rather than wool, and in a little while the sheep were half Lincolnshire, then three-quarters, and often seven-eighths As a result, the people of Europe can now eat antipodean mutton, but the wool market has been disturbed by the great increase of coarse wool and the decrease of fine wool. New Zealand and Argentina have changed the type of sheep more rapidly than Australia, which has clung longer to the wool sheep, because in the latter country the great droughts often make it impossible to fatten sheep for market

Agricultural industries. The rather limited agriculture of Australasia is due in part to the climatic limitations, but even more to the scarcity of population There is little doubt that New Zealand possesses agricultural resources superior to those of Italy, a country about the same size, with thirty times its population But one family with 500 or 1,000 acres can do little more than herd its pasturing flocks, while one family with three or five acres must till it most intensively

In Australia the moisture suffices for wheat growing only on the eastern, southern, and extreme southwestern sections, and her crop varies greatly with the fluctuating rainfall on this desert margin New Zealand is a regular wheat exporter because it misses the belt of scanty rainfall which roughly follows the tropics of Cancer and Capricorn. It gets instead the regular rains of the west wind Southern Australia gets the rain of California, and New Zealand that of Washington state. Like England, in a similar latitude and climate, New Zealand has a splendid wheat yield per acre, about 30 bushels, in contrast to 10 or 12 bushels in

southern Australia. There are a few scattered places where corn is grown to some extent, as in northern New Zealand, and in the eastern margin of Australia, but here it has to battle against droughts and scanty rainfall and is unimportant. The regular excellence and continuous growth of grass gives New Zealand a great natural fitness for the dairy industry which has increased rapidly since the beginning of this century.

The New Zealand Government has taken great pains to inspect and guarantee the quality of exports of dairy products, with the result that its butter and cheese stand well in European markets. This Wisconsin of the southern hemisphere is even reaching out for American markets as several ships from Auckland with five million pounds of creamery butter each, reached New York in 1923. In exports of butter she is second only to Denmark, in exports of cheese she is second only to Holland. Her combined butter and cheese export gives her world supremacy in dairy products. Australia, being further north, and out of the latitude of steady rains, has her production of dairy products sadly interfered with by the droughts, and chiefly limited to Victoria, the most southerly, the coolest, and rainiest part of a warm dry continent.

Fruits. Australia, like the other continents, has its region of summer drought and irrigation (Mediterranean climate). It is in the southwest corner and east of the Great Australian Bight. The irrigation colony of Mildura on the Murray River in northwestern Victoria has under irrigation a quarter million acres of land under the same kind of arid climate that prevails in California, Spain, and Asia Minor, and the people are already producing dried prunes, dried peaches, dried apricots, dried currants, and raisins for the home market, and occasionally exporting to Great Britain, where they compete with the products of the Mediterranean countries and California.

Australia has large vine-growing areas near her arid interior, and it is admitted that the product of certain vineyards is practically as good as any wine in the world. In New South Wales, the farmers have been driven to grape growing because the droughts, although they ruin the wheat, will not prevent a crop of grapes. Owing to the sparse population of Australia, however, its wine production is insignificant. Export, which would stimulate production, still labors under the handicap that the reputa-

tion of Australian wines has yet to be made (see chapter on France and Belgium)

There also appears to be indefinite room for apple growing, particularly in the island of Tasmania, which is about as large as West Virginia It much resembles this state in its mixture of mountain and valley, its good rainfall, and its suitability to the apple, and in its mountain orchards Its orchard area is one-tenth as great as that of Britain Tasmanian apples are sent to Australia and to a limited extent to England South New Zealand with a similar climate sends more of them to the British market The total export from the southern hemisphere, however, is small in comparison to that of the United States and Canada.

Sugar and cotton. The sugar situation is very similar to that of the fruits, but the scarcity of labor is even more acute In the warmer part of Australia there is a very large area of admirable cane land, especially in Queensland, but though the population is less than one per square mile, the strenuous desire of the Australian commonwealth to remain a white man's land has caused the enactment of laws stopping the admission of the colored laborers (Hindoo, Chinese, or South Sea Islanders) who had been the planter's dependence The white men who own the Queensland lands could superintend large numbers of East Indian, Polynesian, or Chinese laborers if they could get them. But this would result in Queensland becoming essentially an African or Chinese or Polynesian community, with but a small percentage of white people. This the other Australians do not wish, and, therefore, they will not permit the Queenslanders to import a single coolie The North and South problem is there also a bitter one, as it was in America in 1861 when the South wanted slaves and the North did not As white laborers will not go to the tropics, the Queensland sugar output is not increasing, and sugar is imported from Fiji Islands where imported Hindoos grow it at home under white guidance

There also seems to be a large area of unused cotton land in Queensland.

Forests and lumber. Australia has some of the largest trees in the world in her eucalyptus, a genus that grows with great speed and is of great value in many temperate lands Except

in the southeast and the tropic north there is not much forest in Australia, and she is an importer of pine from United States and Sweden Certain small sections in southwestern Australia produce two species of export wood. They are members of the Eucalyptus family, the karri and jarri, which, through their hardness and durability in the ground, are well suited for wooden pavements and are exported to European cities for that purpose The northern island of New Zealand has some splendid forests

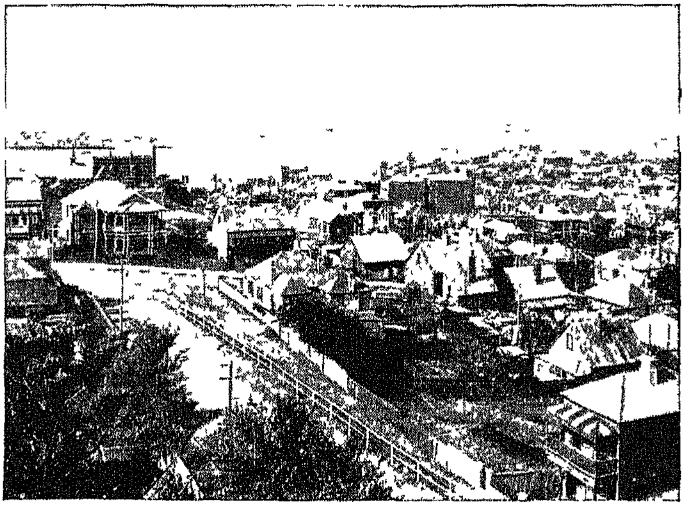


FIG 324—Newcastle harbor, New South Wales Like Newcastle, England, this port is a large shipper of coal

of the gum-yielding kauri, a tree furnishing logs eight to ten feet in diameter and 100 feet long, and also a varnish gum Most of the gum is fossil gum grown on trees of past centuries and dug from the forest floor New Zealand's lumber export, though small, is growing.

Minerals. For half a century minerals have been very important in Australian trade The output of the newer west Australian fields, like that of the mines of Victoria, is declining, with the result that the total gold production for Australia fell from one-fourth of the world's output in 1903, to one-twentieth

in 1922. The number of men engaged in mining has dropped from 71,000 in 1901 to 14,000 in 1922 The individual miner has been succeeded by the mining company with its machinery, and the mines are being worked out. The Victoria deposits, first discovered in 1851, have been worked to the depth of a mile, which is about the limit for mining at present. It is expected, however, that the production of West Australia will continue at its present level, over half of the total, for a number of years,

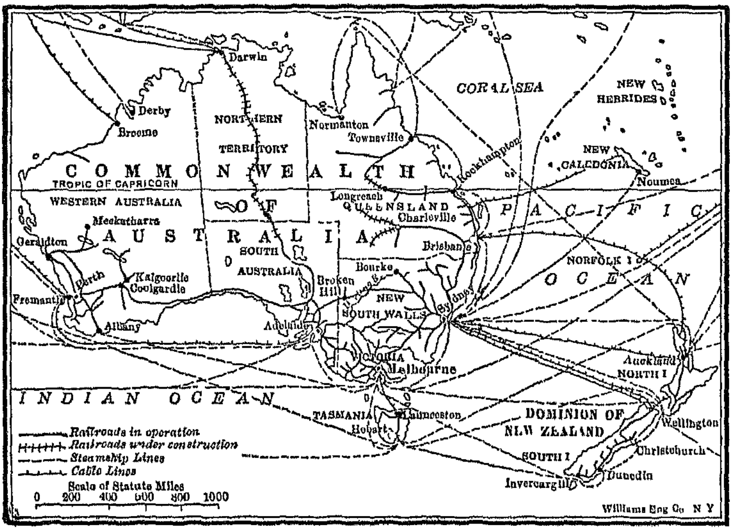


FIG. 325 —Trade route map of Australia.

now that the surface deposits are collected and the working of the deep quartz has begun

There is also some copper mining, but the most valuable of all minerals is coal, of which both Australia and New Zealand have enough for their own needs. Australia with mines near Sydney has considerable export of coal across the Pacific to Chile and California. Coal is found in all six states of Australia and the beds in New South Wales and Queensland are believed to be sufficient for a long time (See Fig 324).

Manufacture and trade. Although the coal and other resources of Australia and New Zealand are extensive, the popu-

lation, small, almost stationary, and less than that of Illinois, does not furnish a labor supply adequate for any large amount of manufacturing There are many small manufactures, and 1915 saw the beginning of iron and steel making, with abundant raw material near at hand, but the character of imports shows that the country is still in the pioneer stage where the high-paid workers of a sparsely peopled land exchange raw materials for

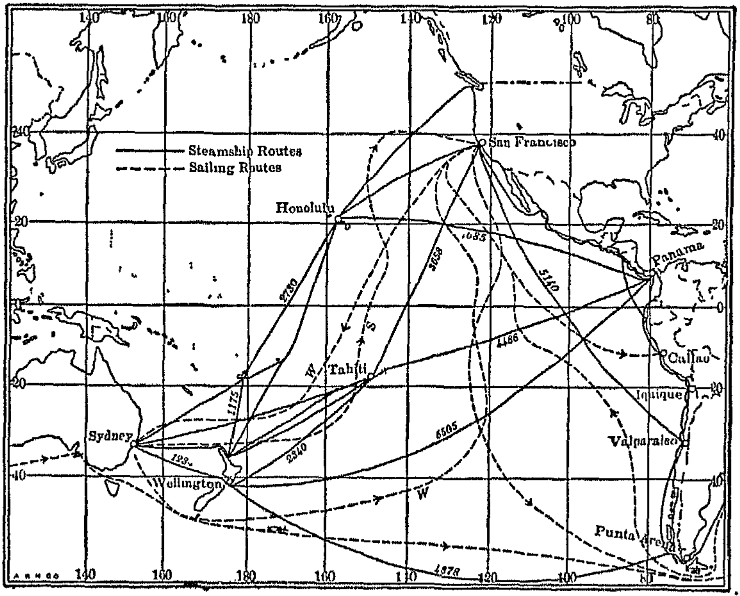


FIG 326 —Routes of Southern and Eastern Pacific Ocean. W—winter S—summer

the manufactures made by low-paid workers in more crowded countries. Most of the railroads (Fig. 325), many of the ranches, and other industries, as well as hundreds of millions of Australian public debt, are owned by people of the mother country, and we see the basis of a part of Britain's heavy imports in the Australian export in a recent year of \$720,000,000 worth, while she (an interest-paying country) bought but \$475,000,000 worth.

Polynesia. The vast expanses of the Pacific between Australia, Tahiti, Hawaii, Guam, and New Guinea (Fig 326) are dotted with a

multitude of islands, mostly very small, often uninhabited, often densely inhabited, and having two great resources,—fish and cocoanuts The cocoanut is most important to these South Sea Islanders, to some of whom it supplies directly an amazing variety of wants and furnishes the only means of purchasing the products of the outside world, which come to them in small vessels, veritable floating department stores that skirt the archipelagoes trading for cocoanut meats and cocoanut oils, which finally find their way to Sydney or the European soap factories—at Antwerp, Liverpool, Hamburg, and Marseilles One of the leading manufactures of Sydney, the metropolis of Australia, is the branch of a British soap company The plant crushes 1,500,000 cocoanuts per week The annual harvest of 23,000 acres of palm groves is brought to it by steamers which scour the Pacific from Christmas Island on the east to Solomon Islands on the west, including Fiji, Samoa, and Tonga. Some of these islands are never visited by any other ships. This one plant at Sydney makes soap, supplies Australia with cocoanut oil, exports much to Europe, and also has as by-products glycerine, and oil cake for cattle food. From New Caledonia comes the white man's complaint that the natives can make a living so easily gathering cocoanuts that they do not care to work for white men or dig in the chrome mines.

Questions

1. Why do Australia and New Zealand differ in the importance of the dairy industry?

2 Why do Iowa and New South Wales, two agricultural states with about the same list of crops and the same market for their surplus produce, differ so much in the crops and animals produced?

3 Explain the status of the Queensland sugar industry and the political controversy that arises from it

4 Compare Australia with Italy and France in grape-growing resources, in grape industry

5 How has the refrigerator ship disturbed the wool manufactures?

6 Australia has iron ore and coal Why is manufacturing developing so slowly?

7 How does the Polynesian with his palm trees reduce the price of milk in Wisconsin and New Zealand, and how does he make living cheaper in Hamburg and New York?

8 If the South Sea Islander gets a good price for copra who finally gets the money?

PART III

WORLD COMMERCE

CHAPTER XLI

EXPANSION OF INDUSTRY AND RESOURCES

1 The Balance between Resources and Human Need

There is frequent expression of the idea that opportunities for making a living are getting fewer, that the world holds fewer opportunities per man than it previously possessed This belief is not founded on geographic or economic fact. A community needs for its support, land for the production of food and raw materials, power with which to manufacture and transport goods, and a good climate to maintain vigor and health While the actual material in the world is decreasing, our knowledge of ways to utilize things previously useless is increasing so rapidly that the unused opportunities for industry (resources) appear many fold greater than our needs, and they are increasing faster than population is increasing This of course is a temporary situation No material thing can keep up for long with the geometric increase of organisms—2, 4, 8, 16, 32, 64, 128,—1024 at the 10th doubling, a million at the 20th, and so on.

The degree of utilization of resources. The question naturally arises, when are resources fully utilized, and when is a country fully occupied? It is difficult to say when a country is full because of the present practice of living by manufacturing and consuming the products of other localities The question of the standard of living is a second factor making it difficult to determine when resources are fully utilized. If the population is content to live in small houses rather than large, to eat grains and vegetables rather than meat and other things requiring more land to produce, then the population can be large. Under the

system of household industry many localities of Europe and Asia have become populated up to the food limit, the non-flesh food limit, and the record of famines in India and China shows those countries to be far beyond the food limit in years of crop failure. Millions of Asiatics have starved beside the railway, which could have brought them food if they had had goods or money with which to buy it

Belgium, Massachusetts, and other densely peopled western localities have passed the point where they can under present standards feed their people from their own land, but they have passed into the stage of buying raw materials, selling them again as manufactures, and importing food with the proceeds. The steady increase of commercial facilities, shows evidence of continuing growth in manufacture, population, and dependence upon the foreign markets and upon foreign raw materials To a large number of people in manufacturing districts, their land is a home space, their sustenance space being, in part at least, in other lands.

The best example of a country approaching the full development of its resources is Japan, with meager mineral wealth, rugged topography, a small proportion of arable land, and a population of 2,400 per square mile of tilled land, nearly four persons per acre Until the recent sudden shift to commerce, and manufacturing, this population supported itself almost entirely by agriculture, with an average area of 2 6 acres per farm family Upon this slim resource, the nation had maintained its physical and intellectual vigor and a high civilization; but to do so they have entered almost exclusively upon the ultimate stage of agriculture, namely, the non-flesh diet and the garden stage of hand labor, which would make Oriental wheat cost $4 or $5 per bushel (sometimes even $10) if American wages were paid

The mystery of the way in which China supports her millions is explained by a skilled American agricultural observer's account of a visit to the farms of the densely peopled province of Shantung. ("Farmers of Forty Centuries," F. H. King. A most enlightening book)

"Every scrap of vegetable matter and excrement is saved and returned to the fields, which yield a harvest of wheat or barley in June, and then with the aid of midsummer monsoon rains, a second crop of millet, corn, sweet potatoes, peanuts, or soy beans." The last two are nitrogenous

meat substitutes and help explain the observer's statement that "One of the farmers in this province with whom we talked had a family of twelve people which he was maintaining on 2 5 acres of good farm land, keeping besides one milk cow (also used as a work animal), one donkey, and two pigs The crops raised were wheat or barley, millet, soy beans, and sweet potatoes" This is at the astonishing rate of 3,072 persons per square mile and also on the same square mile 256 cows, 256 donkeys, and 512 pigs It would be an impossible search to find an American square mile that could feed, under American methods, the animals alone.

2. Unused Agricultural Resources of the Temperate Zones

It is plain that there are two standards for the utilization of land—the *Oriental standard* of hand labor, largely non-flesh diet,

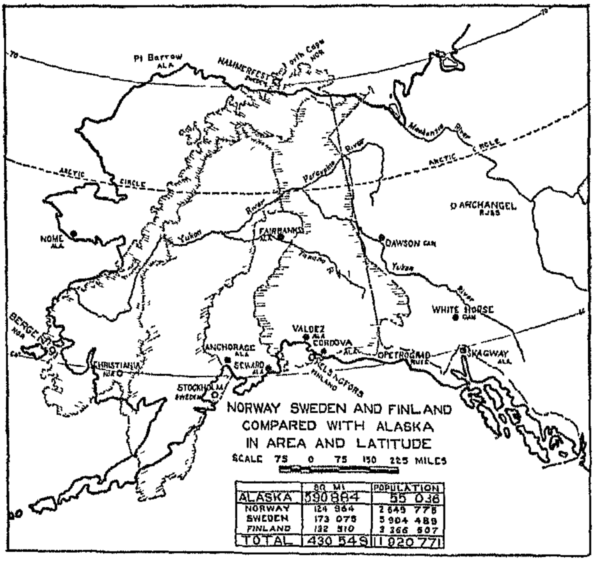


Fig 327 —Alaska may some day produce the same grains and root crops grown by her Scandinavian sisters

and the *Western standard* based upon work animals, machinery, dairying, and other animal industries. Judged even by the western standards the temperate zones have large unused agricultural resources. In contrast to Italy, China, and Japan, we may class

North America, the South Temperate Zone, and even parts of Asia as relatively unoccupied lands.

So little is farm land utilized and sought in the United States that in large areas east of the Alleghenies it is a common saying based upon fact, that when a man sells a farm he gives away either the value of the building or the value of the land, for the price obtained is often less than would be required to replace the buildings Very little of the land cultivated in the United States has reached the intensive stage of double cropping which would often be possible if we had the Chinese pressure of men upon land Also we have an advantage unique among lands of large resources—the great gift of corn for which we have a vast area. Over one million square miles of the United States can produce this king of forage crops, the most productive and easily grown of all the grains Further, this grain lends itself to double cropping, the recourse of the crowded people (Fig 328).

In Japan and China, and wherever possible in Italy, the land is made to yield two crops per year, winter grain between October and June, and rice or other summer crop between June and September Similar double cropping, now almost unknown in the United States, can be done, if need be, in most of the United States corn belt For example, as far north as New Jersey a good crop of peas can be harvested in May and June, and young corn, sown between the rows, will ripen a full crop before frost Even a third crop can be grown and agriculture yet maintain its western standard Cowpeas, clover, and several other leguminous plants will thrive with corn or cotton, enriching the soil with their roots, feeding animals with their tops and making possible a wealth of agricultural production now undreamed of in most of the United States and impossible in sunny Italy, with its rainless summer. Yet even there over 300 people per square mile succeed in extracting a living from the earth most of which is hilly as well as dry in summer

The American cotton belt, with its summer rain, now supporting only from twenty to fifty people per square mile and six times the size of Italy, has easily three times the abilities of Italy in the production of food, raiment, and timber and is many fold richer in minerals and water-power. We have in the United States 100,000 square miles of swamp lands, scattered among the old glacial lake beds in the northeast, in tidal marshes along the Atlantic Coast, in

cane brakes south of the Chesapeake and in the alluvial lands along the Mississippi and other rivers These swamps and 60,000 square miles to be irrigated can be made twice as productive as uplands (Fig 329). But it will take millions more of workers to do it

It is possible to adopt much of the Old World intensification of agriculture and still keep the American large-scale machine processes (see Louisiana rice industry in chapter on Cereals) which

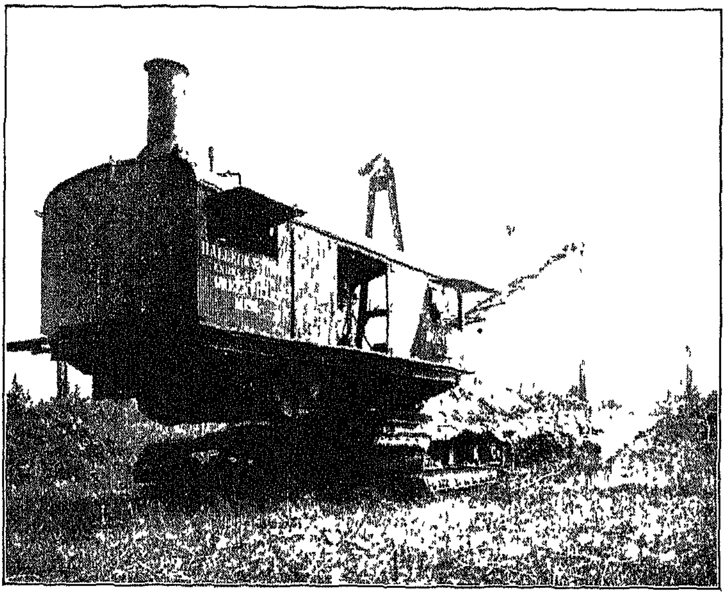


Fig 329 —Ditch digging by machinery on the Mississippi flood plain Note the wheel, called caterpillar It keeps the machine from sinking in the soft earth over which it travels as it digs (The Bucyrus Co, Milwaukee, Wis.)

permit large production per man and a high standard of consumption. The application of science to agriculture is just beginning in the United States and all other new countries, and is now being rapidly pushed forward by the governments of all the leading countries The greatest work for the promotion of agriculture now is the teaching of science to the masses—not more discoveries, but the practice of what is now known, so that we may have an agricul-

ture that is adjusted to resources and conditions. As an example of results of such endeavor, note the following great increases in average yield resulting from 25 years of teaching in Belgium

	1880–85, bu per acre	*1907–10, bu. per acre*	*Increases, bu per acre*
Wheat	24.54	38.55	14.01
Rye	23.86	36.69	12.73
Oats	49.79	81.48	31.69
Winter barley	38.25	57.57	19.32

A comparison of these *increases* with the American yield is surprising. (See statistics in back of this book.)

What has been said of the unused resources of the United States might be said, with varying figures, of Canada, Alaska, Siberia,

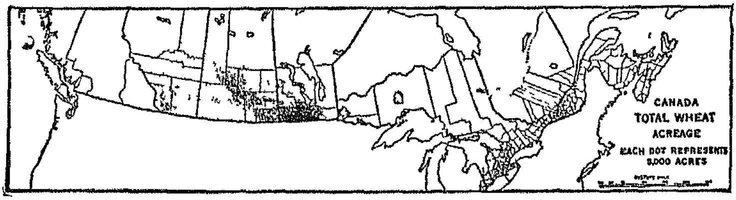


FIG. 330.—The location of the Canadian wheat area shows what a small proportion of that great country has yet been utilized. (Finch and Baker.)

southwestern Asia, Manchuria, and the South Temperate Zone. For example, the South Temperate Zone with millions of square miles of land, has a total population about equal to that of Holland, Belgium, and Switzerland. These large territories, while greatly limited by aridity, have a wholesome, invigorating climate, and resources that will permit a many-fold increase in the population based on a many-fold increase in the production of grain, dairy products, and fruits. Moreover, like most of the world, their mineral resources are but partially prospected.

The North Temperate Zone has a wide area in North America, Europe, and Asia in which the more intensive use of root crops holds out great possibility of increased food supply (Fig. 327).

FIG 331.—The tractor, probably the major agricultural invention of the 20th century.

FIG. 332—The beet, typical of the northern agriculture so little developed in America.

The New England field of forage beets (Fig 332) is symbolical of the northern agriculture which has as two of its great, but least used, staples the heavy yielding root crops—beets, carrots, turnips—as food for beasts and the heavy yielding potato crop as food for man If at any time anyone fears the early approach of serious food shortage, let him consider the possibilities of this northern agriculture and take comfort.

So far as land resources are concerned, Europe may raise many more potatoes than it now grows and North America can easily multiply its potato area thirty-fold and then double the average yield per acre

The potato is second only to wheat in the number of times per year that it is eaten in America, and in Europe it probably stands first. Analysis shows that it is very close to wheat in actual food value, but it contains so much water that we have to eat four times as much potato as wheat in order to obtain the same amount of nourishment

The figures of possible increase may seem surprising but there is nothing unreasonable about them The fact is we have developed in America a systematic warm land agriculture and have not yet reached the degree of food shortage that would compel us to develop a systematic cold land agriculture The chief object of American agriculture is feeding animals, for they eat the major part of the produce of the American farm Up to the present, the price of meat has been so low comparatively that it would not pay us to grow potatoes and beets to feed farm animals, as is the case in Germany, Denmark, and Sweden

The potato and beets have revolutionized Europe, they raised Germany from a third-rate power to a world menace, and if need be they may revolutionize the economic status of a great section of central North America from central Ohio to the forests of the Ontario highlands, and from Newfoundland to Michigan, Manitoba, Alberta, and Alaska

The figure of thirty-fold increase in area is not so astounding when we realize that in the year 1922 we had 4,000,000 acres of potatoes and 103,000,000 acres of corn We have but to put the potatoes a little above corn in acreage

It should be noted that this astounding increase in the production of potatoes which we do not now want can aid in giving us an increase in the amount of grain and milk and meat produce When this higher price level arrives the farmer in Maine, Michigan, Ontario, Alberta, or the Yukon Valley may have a hundred acre farm with crops as follows: 15 acres wheat, or rye, 15 acres barley or oats, 15 acres potatoes, 15 acres forage roots, 5 acres homestead, garden, etc, 20 acres rough land for pasture From this farm wheat or rye and potatoes might go directly to market, everything else being consumed on the place by dairy cows, furnishing enormous quantities of milk, butter or cheese, and some meat.

3. Science Creates Resources

In the face of all these usable but unused resources comes the great growth of science, which is yet young Our new knowledge, applicable alike to agriculture, manufacture, mining, and transport, gives us many new facilities for utilizing things heretofore unavailable Science may be said to create resources of great aid to every land from empty Australia to the teeming Orient, still depending upon human muscle for bearing burdens and running the loom. The tractor is an example of this new knowledge working in the form of mechanism applied to agriculture

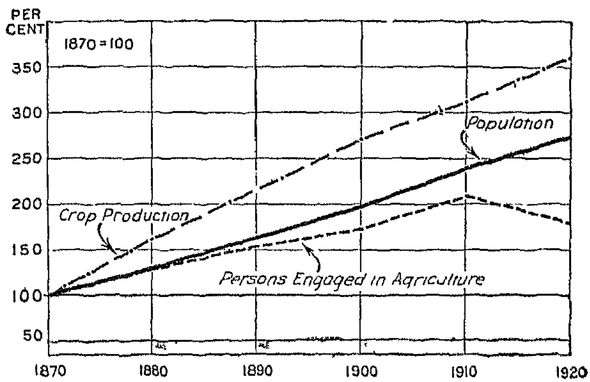


FIG 333 —A chart of profound significance, showing how machinery helps fewer people to feed us (United States Dept Agr)

The probable power of this machine to make wheat and many other crops is almost as little foreseen to-day as was the ultimate effect of the locomotive foreseen in 1840 We have made great strides in the cheap production of wheat by getting tools that depend on the muscle of our strong beasts rather than on the muscle of our weak selves. The four-footed harvester has reduced the cost of grain The iron horse, hitched to the wagon and the boat, has made a new world. The iron horse (tractor) hitched to the plow is beginning to work another transformation, particularly in the world of wheat, probably also in the world of corn and potatoes. It has just begun. The wheat crop of the world is to-day dependent, with few exceptions, upon the muscle of beasts.

The Italians are even still cutting much wheat by hand on their terraces and little odd-shaped patches on their steep and rocky mountain slopes. But most of the land for the world's crops is plowed by the horse, the mule, and the ox, who also draw the seeding drill and the reaper Enough camels are helping to make the list picturesque. At the most, these farm animals may be needed for only six or eight weeks of work in producing the grain crop, but they must eat for twelve months If there is a crop failure every third year they must eat for thirty-six months in order to make two crops, and if there is a failure every other year, they must eat forty-eight months in order to make two crops. Despite their months of necessary loafing they get tired when they work, and must rest They get hot, they get sick, they go lame The farm tractor does not get tired, it does not eat when it is not working We can probably improve it to the point where it will rarely go lame. It can go night and day, and in the rush season a man who has had a long period of rest can work fifteen or sixteen hours a day for many days, and then someone else can take his tractor and, with our present knowledge of lighting, keep it going throughout the night One man, instead of driving three or four horses, turns on the power of twenty or forty or sixty horses that will work twenty-four hours a day. The acreage of level plain that a family can plant with this new help is several times as large as that within the reach of man aided merely by beasts. It is already claimed that in level Dakota a man, with help of his wife and one child, can plant 120 acres

This enlarged acreage means reduction in the cost of wheat growing It means that wheat can be grown in lands that we before thought worthless because of the uncertainties of rainfall. Take the case of some experiments at Cheyenne, Wyoming, which in three seasons produced respectively 9 3, 7 8, and 37 6 bushels because of the difference of four inches of rain in the growing season The average was 18 2. Four of the low crops and one of the high would still average 14 3, a figure that looks well among national averages, made possible by one good season in five. Such farming would scarcely be profitable with the aid of beasts, but it is easily practicable with the aid of the tractor.

In lands of low rainfall it has been well proved that the wheat yield can be increased in quantity and certainty by the practice

of summer fallowing, which means plowing the land one year and raising the crop the next. By this means no plant is allowed to grow during the fallow season and the water which would otherwise evaporate through the growing plants (a surprising amount) remains in the subsoil, where it welcomes the next year's rainfall and combines with it to water one good crop out of the two years' supply The trouble with this system is that it requires much cultivation It is easy to see how the tractor helps at summer fallowing and so will push the wheat fields out into the lands of little rain and of frost The tractor will enable wheat growing to become a dependable business in climates where frost or drought would drive out the team farmer Thus farms, towns, and food-supply may then be found in places where now the farmer gives up in despair

There is no way as yet to reduce to figures what the tractor may do for us, but it probably will enable seven wheat-belts running through five continents to be widened out—toward the region of drought and frost through central Asia and central North America, and toward the region of drought through Argentina, Australia, and South Africa

This possibility of development means that we are in the beginning of another century of spring wheat which has in the last sixty years made wheat more abundant in the commercial world than ever before. The great increase of wheat production in many countries between 1915 and 1920 is partial proof of this point.

Taken altogether, the undeveloped lands of the present wheat regions, the possible regions of the new wheat growing, the new varieties, the new fertilizers, the new knowledge, and the farm tractor, seem to promise that a wheat supply is within our reach for many, many decades if we can devote our powers to the conquest of nature rather than to the destruction of men.

Chemistry is one of the great resource creators of science Suggestive of progress from this source is the synthetic method of making indigo, which is now almost entirely produced from retorts of coal tar rather than the vats in which the people of India and Central America fermented the stalks of the indigo plant. The indigo fields are now free to produce food There is no estimating the number of things of this nature that may be invented or dis-

covered The manufacture of air nitrates by the use of water-power is another example

It therefore appears that in the twentieth century the human race looks out upon a new world—a world newer in the economic sense than the one Columbus showed to the sixteenth century—

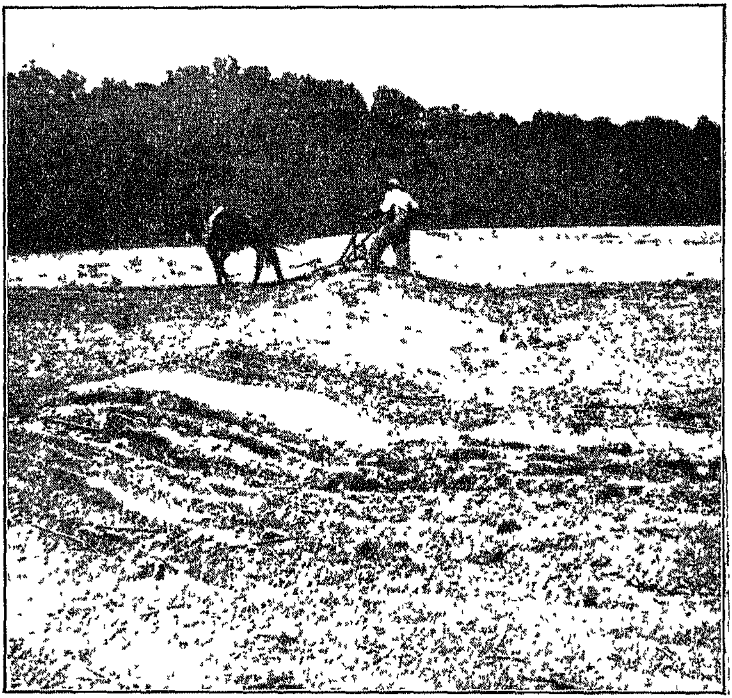


FIG 334—The mangum terrace—a great discovery in agriculture It is a ridge going across the face of a slope so that water will follow it to the edge of the field instead of running down the field and carrying away the soil While it retards erosion in plowed fields it does not prevent the use of farm machinery (United States Dept Agr)

the world created by scientific industry and speedy transportation. Old standards for the measurement of the value of lands to man are gone and the new scientific utilizations are changing that value by a series of improvements more rapid than we have ever before experienced, and the end is not in sight.

New resources for manufacture. Aside from the production of food, the most important single resource for the maintenance of existing civilization is that which will give power to drive machinery At the present time we are depending largely upon coal, which, being a mineral, is one of our surely perishable resources. Unlike the field which may yield thousands of crops, or the forests which may perpetually yield timber or the waterfall which will run on for ages, coal, once used, is gone forever This most important mineral has recently had its economic value doubled

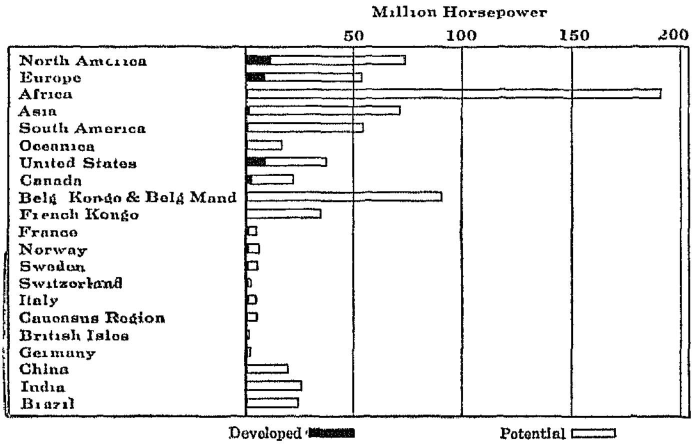


FIG 335 —Man has scarcely touched even his water power resources

by the discovery of the art of making producer gas, which utilizes inferior coal or peat itself, for the making of gas for the running of gas engines—the means of power development most economical in the use of fuel.

Alcohol is, however, a more permanent fuel than producer gas It can be produced from henequin pulp, corn stalks, potatoes, and a great variety of vegetable materials We already know how to use it as a rival of gasoline and kerosene, and it is extensively used for these purposes in Germany, which has no petroleum and much potato land. Alcohol as a source of power permits us to go indefinitely, because it depends upon agriculture, the enduring industry.

The new turbine water wheel and the rapidly developing art of transmission of power by electricity are re introducing a water-power era The full utilization of power, which now flows uselessly to the sea might enable many now sparsely peopled parts of the world to maintain large manufacturing populations unless we chance upon the ability to carry power as far as we please as we now do our voices.

If water-power should become inadequate there are many parts of the world in which the wind blows with great force and regularity This has long been used as a source of industrial power in Holland, and modern windmills, if we choose to use them, are much more efficient than the picturesque Dutch pattern. The sun, the original source of all coal, all streams, and most of the wind, is, through its rays, showering upon the earth's surface unlimited energy, which we may shortly find to be the most easily obtained of all sources of power [1]

All other sources of power pale beside this great source—the direct rays of the sun which hurl into 9,000 square miles of Egyptian desert enough power to replace all the engines and water wheels in the world Three different types of machines have utilized this power to a small extent The success of such power development to the point of superiority to existing power sources offers interesting speculation as to where would be natural seats of empire when the best sources of power were within the zone of 200 or 400 mile power transmission from almost cloudless deserts

Science increases mineral resources. The application of science to the art of mining and purifying minerals and metals had produced changes quite as great as in other fields As it is now possible to work deposits at least a mile in depth, and since, of the 50 million square miles of the earth's surface, we have prospected thoroughly less than one per cent it is evident that we have scarcely touched the world's mineral resources

New resources in agriculture. Food is man's limiting factor. He absolutely requires a certain amount of it and the increase

[1] In 1924 Dr Charles G Abbot of the Smithsonian Institution, probably the world's foremost authority on the sun, constructed a solar cooking range in which a thermometer test showed a temperature of about 350 degrees within its oven—Dr. Abbot expects to demonstrate soon that food can be cooked without coal, wood, oil, or the other fuels commonly used

of the food supply is the thing that will permit man's numbers to add billion on billion in the peopling of the earth Thus agriculture outranks all other industries in importance By the creation of new resources in agriculture, science can give to man his greatest aids to increased support upon the earth

Down to the end of the 18th century, man's progress in the increase of powers and the combat of difficulties was essentially the result of the unscientific effort of untrained workers and the enthusiasm of individuals They tamed the wild animals of the forest, cultivated and improved by selection those plants that seemed most useful, and, by accident, made inventions and discoveries We have now entered upon a new epoch, in which governments and institutions as well as individuals are promoting science and its applications.

We have recently discovered the laws of heredity and the art of breeding and therefore of improving the plants, and to some extent the animals, which furnish us most of our food, clothing, and raw materials These plants become machines, man the mechanic, and the things he can create by the deliberate use of heredity in plants are quite beyond speculation at this time It would probably take many thousand experimenters several centuries to work out a large fraction of the possibilities. Nature has furnished a rich raw material for us to start with. We understand the effects of environments in fitting plants to survive particular conditions If the climate of Arizona is dry, we now know that each and every desert in the world has been developing plants to thrive in Arizona For example, the date is an Old World adaptation of nature to the dry environment. Knowing this, we no longer depend upon chance introduction of plants by immigrants and individual botanists. The search has become definite and organized Thus a new alfalfa from Siberia, or a peach from Mongolia is hardy by the natural selection resulting from 10,000 to 10,000,000 raging winters It is raw material for the plant breeder of the agricultural experiment station, the special endowment, or the garden of the plant lover By this work of the plant explorer and the plant breeder, we can get the new cold-resistant or quick-growing plant that pushes the farm line north, or the new drought-resistant plant that pushes the farm line into arid regions, or the better yielding plant for the fields

now under cultivation The sugar beet has had its sugar content increased several fold within a century—suggestive of changes for the better, that may come to any plant and of changes now actually in progress for many plants Thus surprising results have been obtained in getting strains of corn to be (a) more vigorous and productive, (b) more oily, (c) more starchy, (d) more highly charged with protein than before.

In 1924 the United States Department of Agriculture sent a man to South America where he secured 200 samples of seed corn which matures in the high Andes at a temperature of 20 degrees cooler than that necessary for our own corn. Amazing!

By the combination of the searching of the world's cold and arid deserts and the improvement of plants there found, new crops are already being produced and harvested in lands previously too arid or too cold for any use but scanty pasturages (see Kaffir corn in chapter on Cereals) Every mile the farm line is pushed westward in the Great Plains opens to cultivation 1,600 square miles of farms Under existing American conditions, this added mile will easily support 75,000 people, and in some countries of the world would support several times that number.

The domestication of new plants. Vast additions to wealth, comfort, and industry are to come for the domestication of plants now unused or only produced by unaided nature. For two centuries cinchona was gathered from trees growing wild in the forest, and no one thought of questioning that the east slopes of the Andes had a permanent world monopoly of this precious product, until in 1852, the Dutch government introduced it into Java, and in 1860 the English introduced it into India and Ceylon. The cinchona plantations of the Dutch East Indies islands, with their populous valleys and humid mountain slopes, exported 6,600 tons of cinchona bark during 1922, besides 137 tons of manufactured quinine The price is one-thirtieth that which prevailed in 1870 when it was gathered wild upon the Andean slopes The rubber industry has witnessed the same development in less than twenty years (See chapter on Rubber and on Malaysia.) But the rubber plant itself has not yet been subjected to those processes that produced the English walnut of commerce from a worthless wild nut

New uses for plants long cultivated are equally suggestive.

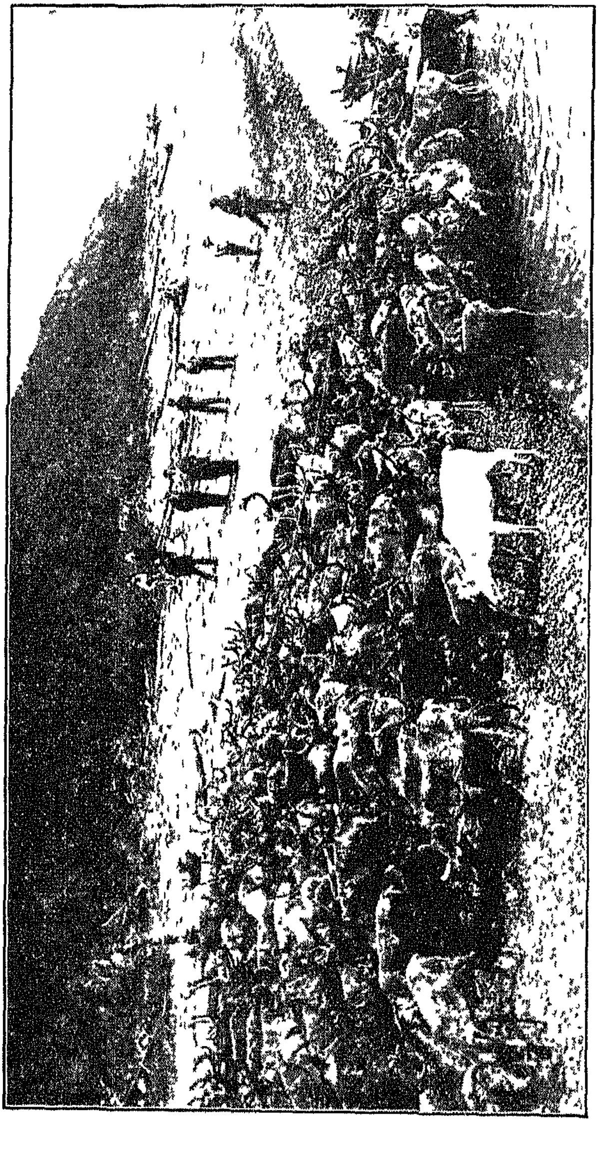


FIG 336—Reindeer herd in summer on the lower Yukon The Arctic pastures hold out a promise of increasing our meat supply

Thus the peanut is replacing corn on the edge of our southern Great Plains where the drought makes corn uncertain At the critical period of setting the ear, corn is blasted by a shortage of water, while the peanut vine merely waits for rain and grows when it comes. Then the hogs root up the crop and fatten upon it The peanut may be considered a partner of the cocoanut in the vegetable onslaught on the animal industries. While the cocoanut is a substitute for butter and other fats, the peanut (see its contents in table of food values) is a substitute for butter, cheese, and meat. Taken together, these two nuts form an admirable example of the shift from animals to plant as sources of food supply (a step toward easy support of larger populations), and also a shift of support from cool to warmer lands

Animal breeding. Another great field where science affects agriculture is the breeding of animals It follows the same laws as plant breeding, and has been understood longer. The work already done in this direction is easily appreciated by comparing the useful cow with the wild buffalo or deer By the application of known science to animal breeding, the efficiency of our domestic animals along many lines can be approximately doubled with little increase in the amount of man's effort in their behalf

The introduction of the domesticated reindeer into Alaska promises to convert the treeless Arctic America into a vast ranch. Starting in 1892, twelve hundred reindeer became more than 200,000 in thirty years and will soon be ten or a dozen million.

4. New Resources Through Tree Crops

Possibly the greatest of all agricultural benefits will come through the utilization of crop-yielding trees and the breeding of new ones—a piece of scientific work for which we are now ready

The essential thing about the earth from the agricultural standpoint is its fertility How to unlock it is man's problem. The key for this unlocking is vegetation, and vegetation must have as aids the all-necessary heat, light and moisture The past insistence on a fourth factor, arability (ability to be plowed), has caused vast possibilities of fertility, heat, and moisture to be practically unused. Also by the plowing of steep lands that

should not be plowed, vast soil resources have been barbarously wasted and destroyed by erosion, to the permanent and profound injury of the earth as a home for man (Fig 334).

Man began agriculture at the wrong end of the plant kingdom The grains upon which we feed are all weaklings Harvest is

Fig 337 —Tree crop agriculture Grafted chestnut trees on granitic hillside in the Department of Ardeche, 70 miles southwest of Lyons, France Value $160 per acre, producing nuts, pasture for goats and cows, and bedding of leaves and Scotch broom

often but a small handful in comparison to yields of tree crops—the engines of nature which have for ages been giving man the most astonishing object lessons of production, and inviting him to improve them rather than the feeble grains at their feet, but the grains are annuals—a profound advantage to the primitive man (probably woman) who started our agriculture.

Great productivity and profit of tree crops. The chestnut orchards of France, Italy, and Corsica yield *per acre* nuts in amount approximately equal to the per acre of wheat fields in the United States The wheat grows on the best, most nearly level, and most easily tillable soil of America, while the chestnut orchards often occupy the steep, rocky, untillable mountain sides While the wheat lands must be plowed for each crop, the chestnut orchards produce their crop without tillage The trees stand among the rocks and at their feet are pasturage and herds to match the laborious plowing and seed time of wheat culture This tree crop is the bread supply, pig feed, horse feed and the money crop of many thousands of mountain dwellers in the higher regions of Mediterranean countries The sale value of these chestnut orchards exceeded that of American wheat land (Fig 337) at the outbreak of the World War

FIG 338 —Fruiting branch of the wild persimmon in Georgia The persimmon is very nutritious and grows wild over nearly a million square miles It probably will become a great forage crop, as domestic animals like it and the tree is very hardy, growing on the poorest soil

Despite this productivity of trees we have until the present depended almost purely upon chance. Freak trees have arisen by accidental hybridizing here and there to become the parents of a variety—Baldwin apple, navel orange, etc

Now, however, science has caught up. We need no longer depend upon chance, the well-tried method of the ancient nomad Plant breeding (scientific, not accidental) is a force that will transform agriculture as the steam engine has transformed transport and the factory It will enable us to harness the trees, the great productive engines of the plant kingdom, and as a result tree crops, the crops of great yield, are to come out of the corners where they now occupy so inconspicuous a place. It is probable that the cultivated fruiting trees of all sorts in the United States do not cover over two per cent as much ground as is given over to the less productive grains As agriculture adjusts itself suitably to resources, the area of tree crops, with their great superiorities, may eventually far outstrip the grain crops. It is almost certainly true that an orchard of selected oak trees will yield in acorns more carbohydrate food, for man [1] or beast per

[1] Anyone who thinks that bread from acorns sounds fantastic should remember three things (1) that bread is merely a carbohydrate food, (2) that whole peoples have lived on acorn bread for unknown centuries, and (3) there are hundreds of millions of people who do not eat bread, certainly not cereal bread, but that is no sign that they are savage, barbarian, or even heathen They get carbohydrate and protein, but they do not get them in bread because the climate in which they live produces carbohydrate and protein most easily in other forms One evidence of tropic riches is the great abundance of starch-producing plants that are bread substitutes Throughout the length and breadth of the damper part of the tropics several easily grown plants afford foods which are the essential equivalent of the dearly beloved bread that two thousand years ago got its place in the most widely used prayer in Christendom

Cassava, one of the tropic bread substitutes, helps to fill the local need in many lands Like the sweet potato, cassava is grown for its starch-producing roots The native grates and dries it, making of it not only a nutritive equivalent of bread, but actually a piece of bread, although it is not the light bread to which the northern world is accustomed, but a thin, stiff cake, rather insipid to the wheat-eating palate. That, however, is a matter of habit

In many tropic lands, cassava cakes and boiled or baked cassava roots are standard articles of diet for the natives, partially taking the place of the corn bread of the American negro, the boiled potatoes and rye bread of the European peasant, and all the other breadstuffs of the temperate zone

Very suggestive is a Hawaiian discovery, a war bread manufactured and sold there for a time in all bakeries It was made of thirty per cent banana pulp and sixty per cent white flour—the invention of a pastry cook in a Honolulu hotel Perhaps the future bakers of Chicago, Oslo or Rio will for a part of

decade than corn can be made to yield on similar land in much of the hilly land east of the Mississippi River But the idea seems like a joke to most farmers, for after all the human mind is wonderfully sealed against new ideas

Already many crop-yielding trees are good enough to be made into crops without any plant breeding at all Among these may be mentioned the pecan, shagbark, hazel, black walnut, English

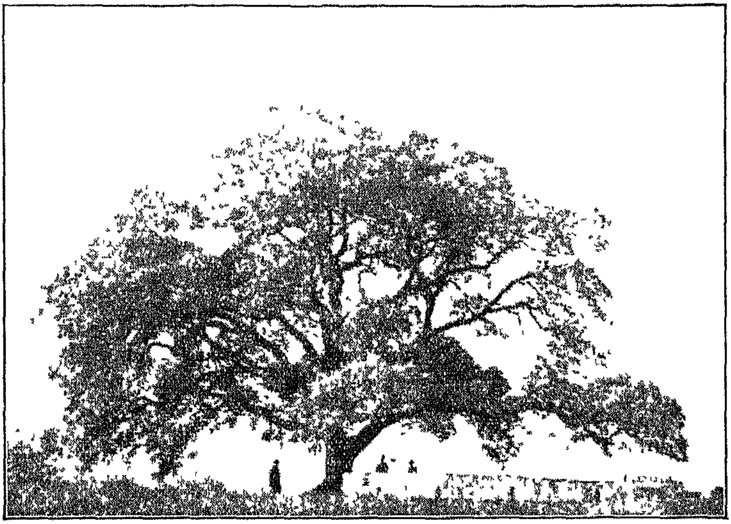


FIG 339—Evergreen oak in Portugal with an average annual record of 750 quarts of acorns This acorn is nearly as good for stock food as some grains

(Persian) walnut, persimmon, mulberry, sugar maple, pawpaw, and above all the oaks—so important in Spain and Portugal

What New England and all hill countries need more than any other thing in the whole list of relations between man and nature is an application of science to give them an agriculture that is adjusted to their unplowable soils The present agriculture of New England is an imported misfit from the lands suited to the plow

Everywhere east of the Mississippi trees will grow where there

then mixture roll out a cask of banana pulp, frozen in a fruit preserving factory on the banks of Albert Nyanza.

is earth standing above the water level With the properly improved varieties of tree crops there is no reason why Massachusetts might not, square mile for square mile, produce as much food as Kansas does now with her fat pigs or fat sheep or fat turkeys—possibly more The proper succession of fruiting mul-

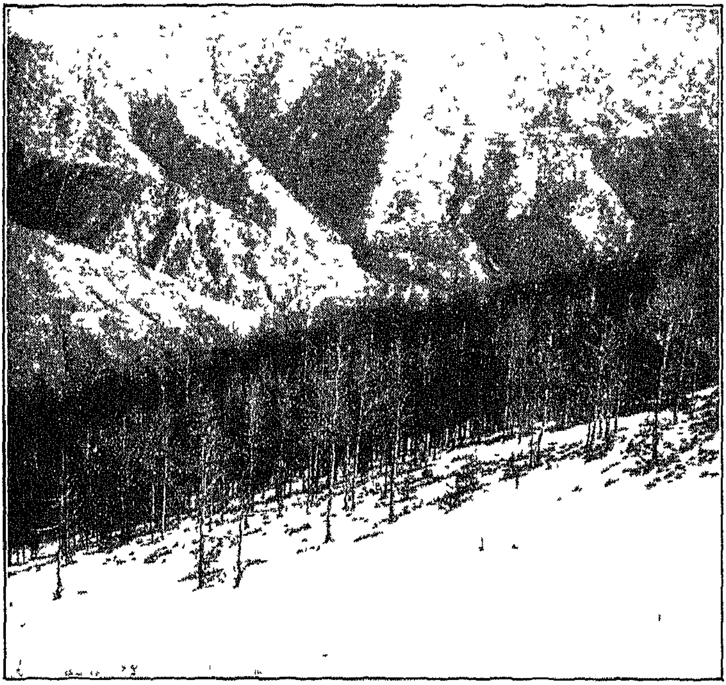


Fig 340—A forest remnant with soil preservation Soil destruction on the tree-stript slope opposite Shansi province, China (F N Meyer, explorer, United States Dept Agr)

berries, persimmons, chestnuts, walnuts, pecans, hickories, shagbarks, filberts, and many other tree crops that might be introduced from this and other lands would give us an abundance of good food or one continuous succession of workless harvests to which the pigs, sheep, and turkeys could walk and eat if man himself did not want them (Figs. 337, 338, 339).

The benefits that tree crops can render the arid and semi-arid [1] land may be equal to those that may be conferred upon the hilly lands. The grasses, grains, and ordinary forage plants are ill equipped to fight for life against the rigors and uncertainty of aridity. Corn, for example, must have water within a certain two weeks or it is blasted, but the trees can prepare for siege. In the first place, their roots can go down from 30 to 60 feet. These roots can

FIG. 341.—Olive trees planted by the Romans in central Tunis more than 1,200 years ago, still bearing good fruit without cultivation and with only 10 inches of rainfall per year. The tree is the most enduring productive device within the reach of man.

store up energy, and when the time comes they can make fruit (Fig. 341).

One of the best examples of a new tree crop is the Hawaiian experience with the algaroba, a species of the mesquite many species of which will grow in considerable areas of the United States. Hawaii has, after many difficulties of a mechanical nature, learned to grind up the beans and pods of the algaroba bean, and thereby added an industry of great promise. The meal resulting from this grinding is worth $25 a ton as a stock food, and is the "mainstay"

[1] See "The Real Dry Farmer," by J. Russell Smith, *Harpers' Monthly Magazine*, May, 1914.

of the dairy industry of the Islands The Hawaii Experiment Station states that an algaroba forest yields four tons of the beans to the acre per year, and one ton of wood That puts to shame 50 bushels of corn (2,800 lbs) and its supporting fodder. The labor of production consists of picking up the big beans, which grow upon a leguminous tree introduced about the middle of the last century from Peru or California

The tree-crop possibilities of the fecund tropics are beyond description or even reference here, but it should be remembered that in comparison to it the temperate zone is a land of poverty of plant species, and that most tropic products are already tree crops—tea, coffee, cacao, rubber, cocoanut, palm nut, Brazil nut, allspice, nutmeg, cloves, cinnamon, cinchona, orange

Man has thought of himself as depending upon a *field* in which to grow his food, but there seems abundant reason to believe that science can, through tree crops, now give him food from any land that grows a forest, and from much land which now grows almost nothing Further than this, the tree crop will have a valuable by-product of wood, a material of which there is now a painfully increasing scarcity The great need is that scores and hundreds of men should start upon this work of tree crop creation where now there are at best but a few dozen at work, most of them private experimenters.

After man the desert. The proper development of tree crops as indicated here will effect the greatest saving in the world conservation movement—the conservation of the soil, our greatest and irreplaceable resource. The Roosevelt Country Life Commission uttered this warning "A condition calling for serious comment is the lessening productiveness of the land Our farming has been largely exploitational, consisting of mining the virgin fertility On the better lands, this system of exploitation may last for two generations without results pernicious to society, but on the poorer lands the limit of satisfactory living conditions may be reached in less than one generation " The saying "After man the desert" is much too true, as the frightful desolation of most ancient empires attests. It has nearly all come through erosion, and tree crops with their earth-gripping roots will practically stop it all, for the tree is nature's method of holding earth on the rocky framework which erosion reveals so near the surface of most of our hills and mountains (Fig. 340)

The ultimate uses of land. The final uses of land to get maximum return with conservation of the soil seem to be about as follows

(*a*) Where heat, moisture, and fertility abound

1 Level or gently rolling lands will be tilled as at present, but planted to more productive varieties of plants, and

2 Hilly, steep, and rocky lands will be put to tree crops

(*b*) Arid or semi-arid lands of sparse vegetation at present can in many cases be growing tree crops

(*c*) Cold lands where the cost of keeping warm is great or where frost interferes with crop production will be left to produce our timber-yielding forests.

(*d*) Beyond the tree crop and forest zones will come deserts of bush and bunch grass and moss-covered tundra to be used as pasture ranges by animals suited to the conditions

(*e*) The bare desert, the bare rock, and the snow field will then as now remain without harvest other than

1 Possible minerals where the earth is visible

2 Possible utilization of deserts for sun-power generators

3 Snow field water-power

5 The Economic Possibilities of the Tropics

The tropics are quite the equal of the winter lands, as a field for the creations of new resources by science While the tropics have great possibilities in the new era of scientific industry, they have for ages lain practically unused Considerable areas of the temperate zone, as in parts of Europe, China, and Japan, have approached the food limit, and most unfortunately a great part of the remainder of the temperate zone lies under the withering limitations of aridity or of low temperatures. In contrast to this, the torrid zone, which includes about half of the land surface of the globe, has far more than half of the area of abundant rainfall Add to this its greater heat with absence of winter, and we behold possibilities of the growth of food plants and, therefore, possibilities of the support of population as great as that of the temperate zone, perhaps greater One great drawback must be noted Tropic rainfall is less reliable than that of the temperate zone This factor has not been studied much nor its results worked out Its chief injury to man has

probably been in the tropic grass-lands rather than the forests.

Despite this richness, 90 per cent of the tropic forest stands to-day virtually as undisturbed, save for the roving garden patches of the primitive agriculturists (see page 603), who occupy parts of it A United States Consular Report gives an interesting example of tropic emptiness

"British North Borneo (area 31,000 square miles) is owned and governed by an incorporated company under a charter from the British government The population of the colony is estimated at 180,000, made up mainly of aborigines, about 15,000 Chinese, and not over 400 Europeans.

"The natives clear small patches of the valleys and hillsides, where they plant rice and vegetables for food For other foodstuffs they depend upon hunting and fishing The manner of farming is decidedly primitive The hoe is the main instrument, and there is no demand for agricultural implements or any kind of hardware except the hoe and a long knife used in war and in cutting the underbrush In all Borneo there is not a cultivated tract of ground worthy of being called a farm. The greater part of the land is yet covered with large trees"

British North Borneo is about one-seventh of the whole island, which is as large as France and naturally several times as productive because the unending heat and moisture of the equatorial belt permit the continuous growth of crops

With the exception of certain island colonies which have become populous under white man's influence, and a few minor exceptions chiefly in southeast Asia, the tropic forest in its full force has baffled man, save the primitive agriculturist, and he has developed only the less productive corners, where nature goaded him with difficulties, stung him into action, made him work or starve, and then often starved him despite his pathetic efforts.[1] Man seems

[1] Famine deaths, India (from William Digby, "Prosperous British India," pp. 130–1)

1800–25	5 famines	deaths	= 1,000,000
1826–50	2 famines	deaths	= 500,000
1851–75	6 famines	deaths	= 5,000,000
1876–1900	18 famines	deaths	= 26,000,000
Total since 1800			= 32,500,000

inclined to take his ease where he can and it seems to require intermittency in supplies to make him work Thus except under Caucasian influence, he has advanced in the tropics only on its arid edges and in southeastern Asia where the monsoon rains of summer make a season of growth alternating with the dry season of the winter monsoon. Under this stimulus and this limitation, India and South China alone in the tropics have become populous, and the occasional failure of the summer rains produces crop failures and famines—catastrophies inconceivable to us of the well-fed West It is a curious commentary on man's relations with tropic nature that he should have become numerous where the famine comes to slay him, and that the equatorial belt with its abundant and regular rains should have remained idle until the Dutch showed us by their wonderful object lesson in Java that this is the world's natural belt of heavy population

Since 1798, the Dutch government, leaving the forms of native government alone, has kept peace in Java and to a considerable extent directed and compelled the industry of the people to provide food for home use and export As a result the population has increased more than fivefold in a little over a century. In Java there are 50,000 square miles with 34 million people, or 683 to the square mile Less than half of the land is under cultivation, and a recent European scientist has estimated that Java may easily support more than twice as many people as it now possesses This would bring its figure up to nearly 2,000 per square mile By applying half of this figure to the whole Dutch East Indies, of which Java and Madura are a sample, comprising less than one-fourteenth, we would have a population greater than that of Europe, and five times as great as that of North America Population of this density over the forested tropics would permit that zone alone to contain three or four times as many people as the entire world now contains, and they would be no more liable to famine than they are in India to-day This estimate includes the Amazon Valley where there would probably be a task of flood control greater than man has yet essayed

The inhabitants of the tropics. If the tropic jungle becomes a field who will labor in it? If three centuries of colonization have shown us anything, they have shown that it will not be the white man He can only come in as the ruler, the capitalist, the planta-

tion manager, the engineer, the sanitarian, the expert, and the professional man And he cannot raise his children there

The distribution of population in tropic America affords excellent illustration of the influence of climate on the white man, the location of his home, and his place in the development of the country The white race has here retreated to the cool plateaus of the interior It has always remained a small, very small, minority, and the native Indian, or the introduced negro, makes up the bulk of the population, with the half-breeds the second element in numerical importance. But the handful of white people rules—a fact not without significance.

If these vacant tropic lands which we of the North claim, but may not inhabit, are to become peopled, it apparently must be by the various black, brown, or yellow races that have become adjusted to the tropic climate.[1] Left to their own devices, the forested tropics have produced tribes with sultans, wars, murders, piracies, slavery, pestilences, and diseases that have effectively kept down population They have never yet developed even second-rate power and have fallen an easy prey to colony annexing European powers Given order and protection and guidance as in Java, they clear up the jungle, populate the earth, and have crops to sell. Thus, by the aid of the acclimatized peoples, these untouched continents may yield unlimited amounts of rice and rubber, sugar, cocoa, oil and nuts, cotton, hemp and other fibers, and a whole host of tropical products which we can buy with our northern goods, especially with the products of factories located in comfortable and energy-creating climates

Relation of tropic peoples to northern prosperity. The development of the dense populations of Barbados, Porto Rico, Java, and Bengal shows that these lands are almost certain to remain essentially agricultural or, at best, in a low stage of manufacturing. The tropic lack of ambition means that they will probably stay indefinitely as colonies or in a low stage of political power so long as temperate zone countries maintain their present civilization. The white races of America and Europe would have nothing to fear from three or five billions of black, brown, or yellow people in the torrid zone. History seems to indicate that a small frac-

[1] "Control of the Tropics," by Benjamin Kidd Macmillan

tion of this population in a frosty climate would in time break out into a world-conquering foray, but in their monotonous tropic atmosphere they would probably be, as they now are, non-militant agriculturists carrying out, as now, the instructions of white men, and our trade with them, largely the exchange of manufactures for raw materials, would be a great source of temperate zone riches, and would easily enable northern lands to double their population The sooner we recognize and act upon the fact that we have a brown man's world and a white man's world, the more comfortable we shall all be, provided the white race can

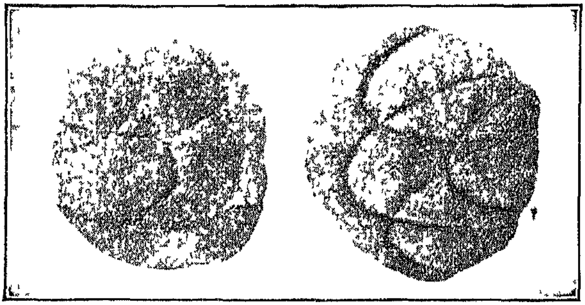


FIG 342 —Sweetmeat—ground root of cassava sweetened with coarse, unbleached sugar called rapadon, purchased in market of Las Cahopas, Haiti, 1917 (United States Dept Agr)

keep on sending some people to the tropics without its own destruction thereby, which is doubtful

QUESTIONS

1 Name several substitutes for coal

2 Compare Italy and the United States cotton belt in the degree of utilization of natural resources, in amount of natural resources, in possible productivety per square mile

3 How may Arizona profit by plant introduction?

4 What happened to the cinchona industry of eastern Peru and Columbia? To the rubber industry of Brazil?

5 Compare the yield and value of French chestnut orchards and Dakota wheat fields. Which would rent more easily?

6. Upon what factors does plant growth necessarily depend?

7 In how many ways may plant breeding extend the area of agriculture?

8 Explain the relation of tree crops to soil conservation

9 How thoroughly are the equatorial regions now utilized by man?

CHAPTER XLII

THE LAW OF TRADE

Trade arises because individuals and peoples, having different goods, exchange their surplus to mutual advantage. This difference in the production of peoples arises from three main reasons—first, the difference in the peoples themselves, second, the differences in the stages of industrial development, and, third, the difference in the resources of their respective lands

SECTION 1 **Racial differences.** The first reason for a difference in production arises from a difference in the peoples themselves. The Japanese and Chinese export to other countries their porcelains, lacquer ware, metal work, fancy paper goods, and other products, which have their distinctive character and value because they reflect a skill peculiar to these Oriental peoples, whose culture is so different from our own From India come many carvings and curios The chief commerce of some American Indians is in basketry, blankets, birch-bark work, and other products of native arts and crafts. Among the peoples of western civilization, the French are conspicuous in commerce through the export of products which are valuable because of the French skill and taste which give them a superior artistic character, and make them precious to the lovers of the luxurious and beautiful everywhere German commerce reached an important position partly through the influence of the scientific attainment and thrift of the German people

It may seem at first thought that the difference in the skill, genius, or culture of races is the greatest cause of trade, but this is not the case Racial difference is the least important of the three main causes.

Racial differences and their commercial results tend to be evened up and to disappear. The relative advantage of German scientific leadership is passing because the Germans themselves taught and are still teaching other peoples their own sciences and arts. America, Japan, and England are copying German sciences and

scientific instruction with all their might, while the Japanese art products are declining because of the influence of European and American machine manufacture under the factory system. The arts of the Indian and the tribesman everywhere tend to vanish before the machine-made product of world commerce. This is also usually a great blow to tribal life and native culture.

SECTION 2. **Difference in the stage of industrial development.** The second cause, a difference in the stage of industrial development, is much more important in explaining the world's present commerce. The difference in stage or intensity of industrial development is largely a matter of the density of population. Two people to the square mile will inevitably support themselves by means which differ greatly from those that will be adopted by 200 people per square mile in the same kind of territory and theirs in turn will differ from that by which 2,000 support themselves on a similar square mile. The sparse population seizes upon the raw products of nature, or produces raw materials requiring the least labor. A dense population, having few raw materials per capita, must fabricate them to a high degree to make value. In the new forest lands, one person to two or three square miles, will make a satisfactory living by trapping fur-bearing animals and gathering gums, herbs, and roots. A population slightly more dense will cut down the forest and sell logs as lumber. A sparse population upon the open plain will employ itself in tending herds of sheep and cattle, and will export wool, hides, and animals. If the population increases and the climate is suitable, the level plain will be carelessly plowed up and sown to grain, which will be exported to the densely peopled region in exchange for manufactures.

This, in brief, is the explanation of the great commerce of the second half of the nineteenth century and of the present. The European peoples settling the comparatively empty lands of America have been producing wheat and sending it back to the better yielding wheat lands of Europe, they have been sending beef and pork to the European countries, where the pastures are better and cattle more numerous per square mile; they have been exporting lumber to the countries where the forests are better kept, because the European population is dense and the American population has been, and still is, relatively scanty. This is the

chief explanation of the commerce of the newly settled lands in Dakota, Nebraska, or Saskatchewan with the older settlements to the eastward whether in England or New England

We even send to and get from Europe articles of the same material but of different degrees of manufacture Thus we export raw cotton and buy fine fabrics and lace, we export logs and planks and import wood carvings from Switzerland, and the Black Forest region of Germany, we export sole leather and import the fancy tans of France and Germany, we sell steel rails and pig copper and buy cutlery and scientific instruments For a time we sent coal tar to Germany and bought the drugs and dyes that were made from it

Owing to the inland movement of the main line of migration and settlement we see, within the Old World itself, a duplicate of the trade that passes between America and Europe The densely populated manufacturing parts of Europe, west of Vienna and Berlin, carry on a most active commerce with the territories of the Baltic and Black Seas, deriving from them products identical with those that come from across the Atlantic. These manufacturing regions have been sending to us and to eastern Europe, woolen goods, cottons, silks, leather goods, machinery of all kinds, metal manufactures, cutlery, gloves, lace, and the thousand products which reflect the great labor and the relatively small raw material of densely populated regions. The new outposts of Western civilization in Australia and temperate South America are to manufacturing Europe but two other Missouri Valleys, with grain fields and sheep and cattle ranges, inhabited by people who buy their manufactured goods and pay for them with grain and animal products. This trade will appear wherever these differences of population are found and land permits Thus in Roman times, France and west Europe sent to Rome furs, cattle, timber, food, and slaves in return for the more valuable goods of Rome This basis of trade, like that depending on racial differences, from which it cannot completely be distinguished, has a strong tendency to disappear through the equalizing of population and industrial conditions throughout the world

The United States and Germany, which for a time were England's great market for her manufactured goods, are now rapidly developing the same industries, and are becoming the great rivals

of England Within the United States itself the whole development is shown. New England duplicates old England in more than name. It is little more than a group of towns and cities whose people live by fabricating raw materials, most of them imported from outside New England, and sending the product chiefly to the west and south in return for the food and raw materials of those newer and less populous sections of the country Ohio, which, 50 years ago, was to New England both market and source of supply for food and raw materials, is now becoming ever increasingly her rival in manufacturing, and turns for her supplies to the yet newer West and to foreign lands The cotton industry of America, once centered in New England, is rapidly being built up in the south, and manufacturing of many kinds is being carried on in greater and greater quantities beyond the Alleghenies, so that the North Central States are coming to resemble New England as New England has come to resemble old England Every state and every country desires manufacturing industries (sometimes unwisely), and they are increasing in every state in the Union, and in almost every foreign country.

Immigration. Lastly, but by no means the least important, comes the immigrant to even up the population physically and to complete industrial similarity, so far as it pertains to the labor supply The cheapness of the Atlantic passage and the distribution of knowledge of American industrial conditions throughout Europe permitted greater and greater movements of people to America, to take advantage of her industrial opportunities. Already more than a million have come in a single year until we have become alarmed and retarded the numbers. But even with this stop there is no reason why, in a few generations, this country shall not become as fully peopled as is Europe

This growing likeness in industries and population is accompanied step by step by the cessation of trade in those articles for which the necessity ceases as America comes to produce an article previously secured in Europe A few decades ago most of our iron and steel was brought from England Now we export it occasionally to England. The import of textiles, chemicals, and other manufactures is falling off in consequence of American production. The large import of sub-tropic fruits and dried fruits from Mediterranean countries has almost entirely ceased

through the development of identical industries in California and some of these products are now exported

SECTION 3. **Difference in resources.** Trade arising from difference in resources is one of increasing importance and is one which man affects but little, a fact which will become of greater and greater influence the more fully we adapt our use of each section to its resources The chief of these differences are those of topography, soil, moisture, nearness to sea, temperature, and mineral deposits.

Differences in topography give rise to a trade which will endure The products of the well-used mountain and of the well-used plain must forever be different. The rough, rocky, and steep lands cannot be tilled, but they are the natural home of the forests, of wood and tree products, and of the mining and quarrying industries. The full utilization of mountain countries means, therefore, minerals, wood, nuts, fruit, water-power, paper, and the possibility of printing and publishing and the manufacture of varied light imported raw materials through water-power But the mountain needs the agricultural products of the open plain, grain for bread, animals for meat, wool and cotton for clothing, and the many other products of agriculture, which can be paid for with mountain products. Such is the trade that does now and may for centuries pass between the prairies of west Canada and the glacial regions north of the St Lawrence, between hilly New England and Appalachia and the level West, between Switzerland and Hungary or Argentina.

Soil differences also make trade Along the banks of the Mississippi, Ohio, and other streams are glacial sand plains in the midst of the fertile black prairies of the corn belt. The sand plain, too poor to grow corn, just suits melons and sweet potatoes, which the farmers grow in large fields, and peddle in wagon loads across adjoining counties, or ship by train loads to adjacent states to be bought up by people who can grow corn, but who cannot, on their richer, heavier, more valuable lands, grow good melons or potatoes. This example is typical of the vast trade that is now developing between the sandy districts in the Atlantic plain and elsewhere, and the rest of the United States Though the most conspicuous, this soil difference is but one example of many others.

The differences in moisture give us the humid and the arid lands between which there is a great and growing trade. Beyond the bounds of cultivation in all countries that verge toward the desert are the sheep and cattle ranges, where sparse population has two or three products to sell, and must buy most of its food from more favored farm lands, and must secure from the manufacturing towns all the other products that are to be purchased in the store. In the irrigated oases of the arid lands, dried fruit is produced most easily, and it is already being sent from these favored spots in Australia, in Argentina, in Chile, in South Africa, in Europe, and in the United States to the more humid districts, which can with ease produce other products for exchange. This exchange of dried fruits and animal products for grain and manufactures is world wide and seems to be as enduring as variation in rainfall, the distribution of people, and the ability to transport with ease.

The Shore lands carry on an enduring trade in fish with the inland regions. Many cold and rocky coast lands have such a great resource in sea products that they can command in exchange the products of all other climates.

Temperature as a basis of trade is the most fundamental, the most widespread, and, for the future, the most promising of great and yet greater performance. No exchange of culture, no equality in education or skill, no emigration of peoples evening up density of population can change the temperature and make tropic fruit grow in the land of arctic fur, or cotton grow in the land of spring wheat. Europe is nearly full of people but Norway has an active trade with France and Spain. If America becomes a second Europe, Manitoba will have a lively trade with Texas, because Texas can produce cotton and other subtropic products, which the short summer forever bars from Manitoba. Florida and other southern lands will send their oranges and vegetables to the northern lands of frost when the latter's agriculture is frost bound, and the north will send in return its wheat, the red apples from its hills, and the myriad products from its mills. Examples in miniature often permit us to see the tendencies of the time more clearly than larger and more complicated examples. Thus the Canary Islands, snugly fixed on steamer routes in the frost-free waters of the warm Atlantic, have

within 30 years developed an export of over 200,000 tons per year of bananas, tomatoes, and early potatoes, mostly to the English market

The future course of trade. This north-south trade is the trade of the future It gives the things we cannot ourselves produce, and is needed to round out the economic life of northern and southern lands alike Foods make the most important class of commodities from tropic and sub-tropic lands Northern peoples want their cane sugar, cacao, coffee, rice, spices, bananas, and other fruits; their cocoanuts, Brazil nuts, palm nuts, tapioca, and many minor foods. We of the temperate climates want, for our mills, their raw materials, rubber, Manila hemp, jute, henequin and other fibers; their cabinet and dye woods, their rattan, gums, palm oil, and other forest products In exchange for these the northern lands are sending machinery, clothing, and all kinds of special manufactures and some foods This is a natural trade

At the present time the great bulk of our commerce depends upon differences in the stage of industrial development—east and west trade—but the future is indicated by changes now in progress. The greatest rates of increase are taking place not along east-west lines, but in the trade of temperate with tropic regions, and, if the present rates of increase in this traffic continue throughout this century, it will far surpass that on the east and west lines. The east and west trade will probably not decline in absolute quantity, but will gradually become relatively less important as the world's commerce multiplies itself many fold, as it inevitably will if its present tendencies continue

SECTION 4 **Size of country and volume of foreign trade.** Foreign trade, depending thus upon natural laws, modified by man's aid and interference, is of varying importance in different countries, with the general tendency to be least important in large countries and most important in small countries China peacefully and successfully ignored the foreign world for many centuries, because she is a world within herself She scorned the world because it could give her nothing that she did not produce Petroleum, cheap cotton cloth, modern machine manufactures, and new machinery have tempted the Chinese to buy; but their foreign trade of less than $4 per person is insignificant to-day. The foreign trade, however, of a country like Uruguay, a little fertile cattle and sheep

ranch, is over $100 per person, among the highest in the world, because Uruguayans produce essentially one class of articles, with which they must buy everything else which a civilized people consumes. Small countries like Switzerland, Belgium, and Holland, with almost no variety in climate, and accompanying small variety of resources, have a relatively enormous foreign trade. So does England If we had the figures of commerce that cross the southern and western boundaries of New England we would be astounded at the total. But most of New England trade is with other states of the Union, and disappears without statistical record in our vast domestic commerce, which is said to be more than twenty times as great as our foreign commerce. Our great area and variety of resources give us a smaller per capita foreign commerce than that which is shown by the countries of Europe, especially such small countries as Denmark or other western European countries

To see commerce in its extreme development we should look at the Falkland Islands, a wind-swept sheep-range and whaling station with an area of 4,600 square miles, and a population of 3,400 people, whose foreign trade is about $4,400 per person per year This surpasses the little French colonies of Miquelon and St. Pierre—a few thousand fishermen and ship outfitters on two barren rocks in the cold Gulf of St. Lawrence, who import and export each year the enormous total of about $700 for every person in the colony. In contrast to this the per capita foreign trade of the United States is about $60, and that of Great Britain approaches $200 per year.

CHAPTER XLIII

THE WORLD HIGHWAY—THE OCEAN AND ITS CARRIERS

The sea, sea trade, and sea power have always been of great interest to civilized man, and to understand world commerce we must first know the part played by the ocean. The nation that does not touch the ocean is like a house that is not upon the street, and some of the bitterest strifes of history have been fought for the possession of bits of coast. Once a nation has reached the sea, it has possessed itself of a part of the world highway that reaches everywhere and belongs, according to international law, to each and all who own even a tiny strip of coast.

The freedom of the highway. It is an adage that ocean transportation is cheaper than that on land, but it is difficult for the landsman to realize how much ocean carriage differs from land carriage in cheapness and in the freedom of competition. This freedom is chiefly due to the same cause which produces the greater cheapness of transportation, namely, the fact that the ocean carrier must furnish only the vehicle, while nature furnishes the roadway, and, in some cases, even the motive power—wind. Upon the railway the cost of the vehicle is an insignificant part of the total cost of service. The important thing is the way itself. On the ocean the way is free and also the place for the ship to unload is usually found with comparatively small expense to the ship, so that ocean transportation remains competitive and cheap both on the international high sea and within the shadow of the land. Terminals remain practically free or, at least, equally free to all shipowners because the desire of cities for trade is so keen that they bid for ships by getting harbors and docks ready for them.

The two types of ocean service. This freedom of the highway and of terminals results in a great variety of traffic methods, but the whole of ocean commerce may be divided into two large classes.

1. The line traffic—with which everyone is more or less familiar—carries the passengers and mails and certain kinds of freight. It

corresponds to the express, passenger, and fast-freight business of the railroad The line service is in the public eye and achieves a degree of attention which is much beyond its relative merits as a freight carrier 2 Charter traffic—single vessels operating as units, as is any wagon that is for hire on the street corner—handles

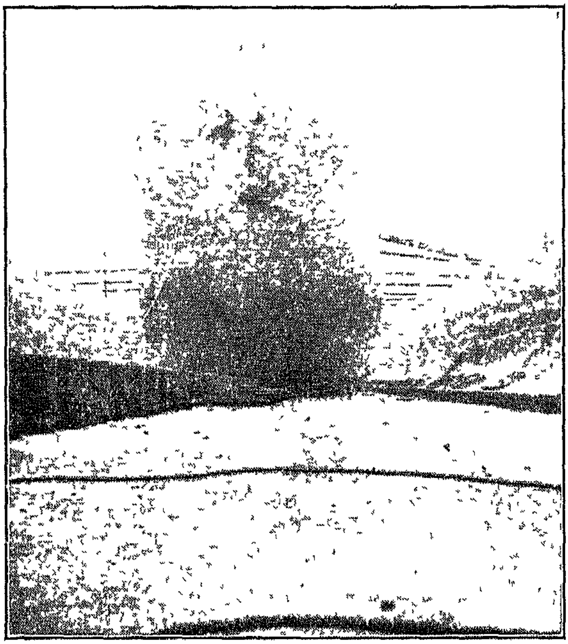


FIG 314 —A tramp steamer in dry dock shows how nearly cubical she is—about 81 per cent

the larger part of the ocean's freight It is entirely an individual matter between the shipper and the shipowner. The individual ship, which is known as a charter ship, or more commonly as a "tramp," is on the list of some ship-broker or brokers who secure a freight for her on commission, and she goes about her work unnoticed by the traveling public or by the headlines of the newspapers

The tramp vessel that is free to go when work offers, and to lie

in port when it does not offer, has a distinct advantage over the line vessel, which must go on a certain date, full or empty, must maintain a schedule and make sailings to ports of call, which in themselves are often unprofitable, but which are necessary, since a line vessel must maintain a reputation, establish relations with shippers, and form a clientele The ambition of the liner is regularity and reliability, the ambition of the tramp is cheapness. (Fig 344)

The charter or tramp vessels. The freedom of the sea makes competition easy, but it is especially easy among the tramp vessels The owner of a single ship is in a position to compete in the world's freight market, and can take service on any sea, in any country, and from hundreds of ports The ocean is a world ocean, the ship market is a world market, the charter traffic is a world traffic, and the ocean rate a world rate Wherever freight offers, there the ships may go and do go [1] If there is grain in volume in the Black Sea the ships go there, and the same is true of India, Australia, or South America.

This tramp steamer, which may be built and owned by anybody, and which may sail in all seas, and carry the products of any or all countries, is a remarkably free agent. It is to be had, however, only by those persons who can afford to load a whole ship, and that is about the only limitation upon the character of product that is carried by the tramp vessels First in the class comes grain, then we have sugar, ores, coal, nitrate of soda, cotton, lumber, china clay, petroleum and many other bulky raw commodities. Only occasionally some manufacturer ships enough heavy goods, such as steel rails, locomotives, and agricultural machinery, to fill a vessel, in which case he almost invariably

[1] "Here is the Olaf Nordsen of Stockholm, Sweden (in New York harbor) She is about 8,000 tons and a heavy broad thing, with a short funnel, and two stumpy masts rigged with derricks She looks a seaworthy ship and probably is The Scandinavians are a hardy race of seafarers and know good ships We will hail the man hanging over the stern and ask him when they left home

"'A year ago,' he answers in broken English, 'We go to Vigo in Spain, den to Italy, den to Tunis. After dot we vent to England, den come here' She wouldn't have much speed, maybe ten miles an hour, and it would take time to travel all the distances she has been And unloading cargo is a slow business in Spanish and North African ports"—From "New York Times," June, 1924

wheat crops or other freight supplies toward which he can work his ships with a chance of securing another freight.

Because of this free market, ocean freight rates fluctuate greatly. When cargoes are scarce rates sometimes decline to the point of heavy loss to shipowners, and, conversely, they may rise to great heights, for when the freight is plentiful and the ships are scarce the only limit to which the rates may rise is set by the limit that the shippers can afford to pay to get a particular cargo carried. Thus a tenfold increase in rates came within a few months after the outbreak of the World War in 1914, and later it again increased many fold. After the World War idle ships rusted and rotted by the hundreds in many ports.

The cooperation of tramp traffic and liner traffic in world commerce. This tramp traffic bears a very fundamental relation to world commerce because it carries the heavy commodities—the raw materials and food—without which the manufacturing city and the manufacturing state as at present constituted could not exist. The era of world commerce in its present sense may properly be said to have begun about the middle of the nineteenth century, when Great Britain began the heavy importation of food and the wide export of manufactures. At this time came the steamship, and lines were established between Europe and America, and between Europe and all other countries, and between New York and the West Indies and Colon, and from Panama to San Francisco and to Chile. These two types of ocean service work together like freight trains and express trains. The tramps handle the trade of vast quantity, the liners handle the trade of high value and the shipments of small size and great number. The lines, therefore, serve the greater number of shippers. They serve the multitude who cannot fill a ship with one consignment, and among manufactures there must be thousands of small shipments of finished goods to one that requires a tramp to handle it. The manufacturing state may depend upon the thousand tramp ships that bring food and materials, but there is an equal dependence upon the 300 big liners that carry to market with greater speed the myriad small consignments of manufactured exports. Conversely the raw material producing country like Argentina depends largly upon tramps to take its exports and bring its coal, and upon liners to bring its imports of valuable manufactured goods.

In most seas the line managers have been able to combine and control *line* rates to some extent. The tramp managers have been unable to do this

It is also true that the line traffic is gaining on the tramp traffic and the development of some line enterprises has reached huge proportions The law of growth among steamship lines works surely to the development of trunks and branches, a development which has already taken place, although the branches are fewer than upon railroads The great ocean liners sail with precision and regularity To secure the supply of freight for these great lines, their managers have been compelled to establish smaller lines to supply and distribute the necessary cargo The largest trans-Atlantic lines are, without exception, thus equipped at one or both of their terminals Before the World War, Germany with her systematic promotion of foreign trade, had furnished us the best example of this The North German Lloyd and the Hamburg-American connected at their European ends with lines running to South America, east Asia, and other distant parts of the world They also connected with smaller lines plying to the nearby European ports and with steamers on the German rivers These two German companies carried the same system even farther. Their trunk lines to east Asia were fed at Singapore and other eastern ports by lines of smaller German steamers which traversed the eastern archipelagoes and the Asiatic coasts and rivers, collecting cargo for the trunkline stations of the large steamers bound for Bremen or Hamburg, at which ports it was transferred by the European distributors referred to above or sent on to America by the trans-Atlantic lines of the same companies The Wilson Line from New York to Hull connects in that city with an enormous fleet of small steamers which thread the coasts of the North Sea and reach all ports of importance in Scandinavia and along the Baltic. The French and Italian trans-Atlantic lines are fed by fleets of Mediterranean coasters and trans-oceanic liners at Havre, Marseilles, and Genoa The ocean service of single companies at times circumnavigates the globe.

The best example of this wide-reaching world carrier was furnished by the Hamburg-American Steamship Company at the outbreak of the World War This one company dominated the metropolitan city of Hamburg and connected it with Montreal,

Portland, Boston, New York, Philadelphia, Baltimore, Newport News, New Orleans, and Galveston in the eastern United States. It sent steamers to Mexico, Central America, Panama, Colombia, Venezuela, and several services to the Lesser and Greater Antilles. They went to the Amazon, to the ports of central and south Brazil, to Uruguay and Argentina, around to Chile and Peru, and up the Pacific Coast of America to the ports of the United States In Europe they circumnavigated the British Isles, skirted the coasts of France, Spain, Portugal, and Italy, to the head of the Adriatic, they went in the Baltic to Russia and Finland and Sweden, and out in the Atlantic to Iceland and North Cape, and on to Arctic Spitzbergen in the summer. In Africa it touched at Alexandria and down the whole west coast as far as the mouth of the Congo. In Asia it served Aden, the ports of Arabia, Persian Gulf, Ceylon, Calcutta, Straits Settlements, China, Korea, Siberia, Japan, and finally—and possibly most remarkable of all—it sent steamers thence across the Pacific to Portland, Oregon—a grand total of sixty-eight services crossing every ocean, touching all continents and every geographic and commercial zone. Extensions were in contemplation or contracted for. This will doubtless be restored in time, as Europe recovers from the war, for it is the normal way for ships to work There are many more examples but none quite so far-reaching as the Hamburg-American system was.

CHAPTER XLIV

THE NORTH ATLANTIC ROUTE

The greatest of all ocean trade routes is that crossing the North Atlantic and connecting the two most commercial continents. To a person who has not given attention to the geography of the North Atlantic it might seem that this ocean possesses a multitude of trade routes. Yet there are certain geographical conditions producing a surprising similarity in the path followed by all of the ships going across this ocean from North America to northern Europe.

The greatest factor leading to the use of this common path is what the mariners call "the great circle line." This can be best understood by examining a globe, the only map that is accurate for large areas. By it one sees that in high latitudes the shortest line between any two points equidistant from the equator is not on the parallel running due east and west, but along the arc of the circle passing through both of the points in question, and dividing the earth into two equal parts—a great circle. The farther apart the two points in question are, and the farther from the equator they are, the greater is the poleward curve of the shortest line between them. Consequently, there are almost no straight east and west routes upon the charts to be followed by the mariner. He is forever following curves, because he is, of all men, the one who is most directly concerned with the fact that the world is round.

It is rather astonishing to discover that the positively shortest air line from Sandy Hook to Liverpool passes directly overland through New England and Canada, west of Nova Scotia. The more closely ships can approach this great circle line, the shorter is their voyage, consequently, as soon as it is possible, all vessels leaving New York abandon their eastward course and swing northward along the line of a great circle, the exact point for this turn varying with the seasons. At all times of the year the vessel must proceed eastward, sometimes hundreds of miles, before it is permitted to turn to the north. Only by this means can the navigators avoid the worst dangers of the Newfoundland coast and the fog banks.

The great circle swing makes the vessels from New York, Halifax, and Montreal approach each other before mid-ocean is reached. For a part of the year, often less than half, the St. Lawrence steamers make an exception to this by going north of Newfoundland

An examination of the globe, or a photograph of part of it shows that the east coast of the United States, of which we often think as extending from north to south, really lies so near east and west as to

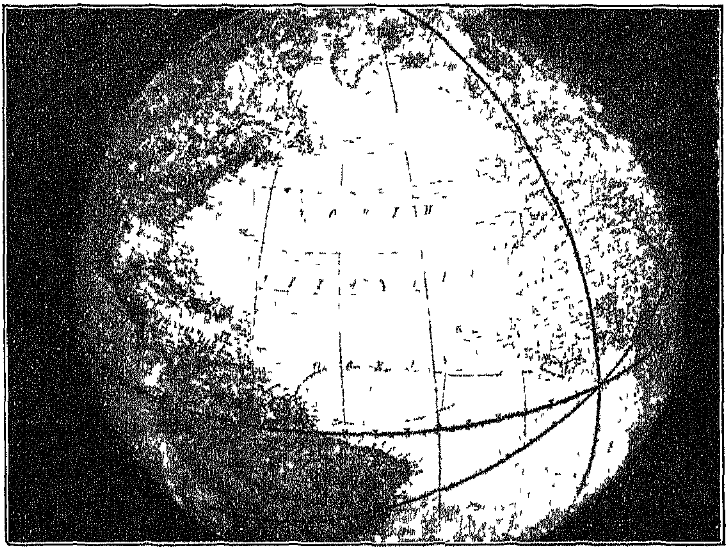


FIG 345—Globe showing narrowness of North Atlantic and cause of location of North Atlantic trunk (Photo E Stirling)

be practically a part of the great circle line from the Georgia coast and the Florida straits to Scotland, so that the ships from South Atlantic and Gulf ports follow the coast and take the same trunk route as those from the North Atlantic. Even Nicaragua is almost within the territory of this same North Atlantic route, for it is but 323 miles farther from Greytown to Liverpool via New York than via the shortest possible route It is thus plain that the North Atlantic route is a great trunk route with a string of branches for the different ports from St. Johns in Newfound-

land to Havana, Tampico, and Vera Cruz in the tropical Gulf (Figs 345, 346)

It is, therefore, exactly in accord with these basal facts of location that there has arisen a trans-shipment trade at New York and New Orleans by which the products of the West Indies and Caribbean countries are being forwarded to Europe by the great trans-Atlantic liners, and return cargoes come by the same route

It is a working out of the narrowing longitude of high latitudes that causes Quebec and Montreal, which we are inclined to think of as being far in the interior, to be nearer to Liverpool than are New York and Boston, while the distance is no greater to the trading posts located far in the center of the American continent upon the western shores of Hudson Bay—a fact interesting to speculate upon in connection with Canada's announced intention of building a railroad to Hudson Bay

The North Atlantic route has the great advantage of being entirely devoid of islands with the exception of Sable Island—the so-called graveyard of the Atlantic—east of the Maine coast and a few small rocks on the Grand Banks So universally are these skirmish posts of the continent dreaded that the route for the trans-Atlantic steamers aims to interpose 60 miles of clear water between the ship and these destroying landspecks This is the more necessary because of the mingling together of the Arctic current and the warm Gulf Stream which produces well-nigh continuous fog on the Grand Banks. The handicap resulting from these difficulties is well illustrated in the St. Lawrence River, one of the feeders of the Atlantic route, where the narrow and rocky channel has been frequently the scene of great disasters and where at the present time ships must often tie up during the night. One result of these dangers is an insurance rate often several times as high as that for open-sea voyages

The icebergs, afloat for half the year in the vicinity of the Grand Banks, are a greater menace than a group of islands

Another dangerous part of the route is Cape Hatteras, which really projects into the Atlantic and, with its long strings of sand bar reaching out to sea, must be rounded by hundreds of vessels from the south. In the temptation to save distance, many a good ship has ventured too near these bars and met her end.

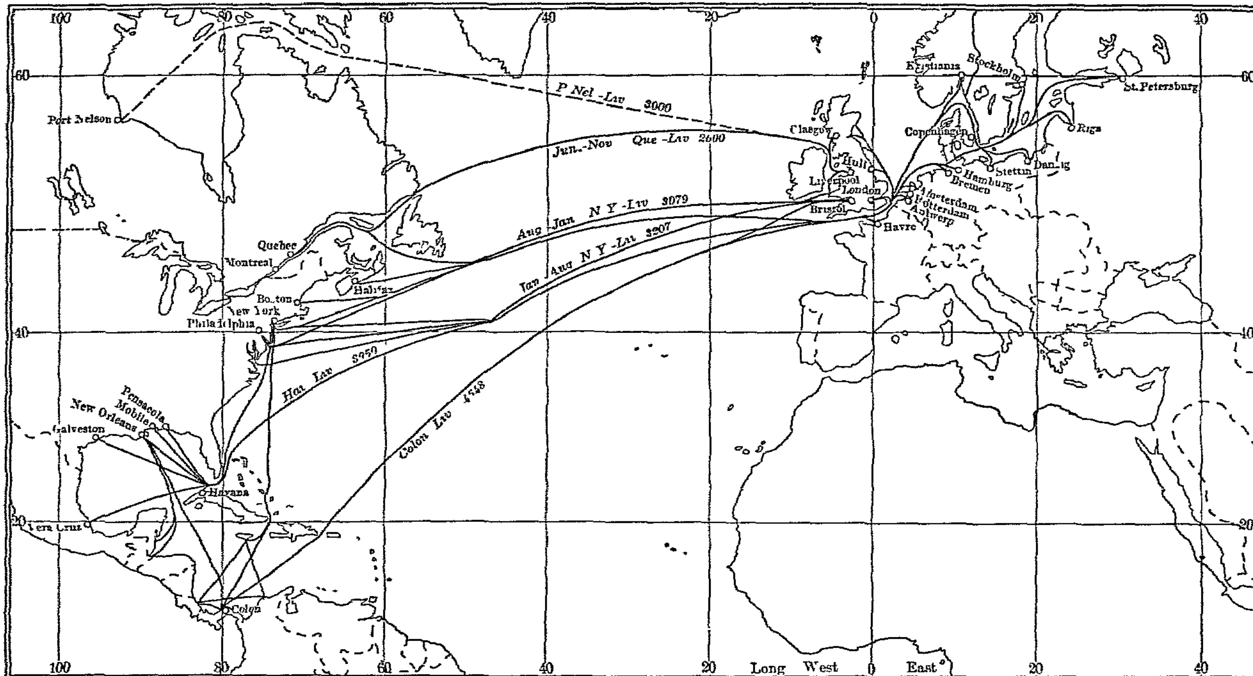


FIG 346 —North Atlantic trunk route

Fuel supply. In the present epoch of steam no route equals the North Atlantic in the abundance of the supply of fuel Eastern America and north Europe are producing 95 per cent of the world's coal and on both continents this supply is admirably distributed for the supply of steamers The American supplies at New Orleans, Mobile, Norfolk, New York, and Nova Scotia, are known to the reader The European end has a distribution of coal that is not less complete Southern and western England with the ports of Bristol and Liverpool are supplied from the rich fields of Wales and Lancashire, Glasgow almost overlies the coal-fields of western Scotland On the east lies Newcastle, synonym for coal, Antwerp and Rotterdam, the great ports of the Rhine, are in reach of Rhine-borne coal from Westphalia and Belgium, Hamburg and Bremen receive their coal very cheaply as return cargo in ships which carry sugar to England, and German coal can also come on barges from the Rhineland Another fuel supply that should be mentioned is the oil of Texas, Kansas, and Oklahoma in the lower Mississippi Valley This is now used to a considerable extent and will continue to be a favored fuel as long as petroleum remains plentiful and cheap

Traffic. The North Atlantic route began as one over which fishermen sailed to the Grand Banks and emigrants left Europe to start new homes in America, and, strange to say, this emigrant traffic, which was the first over this route, was one of the greatest until legislation checked it In the first 10 years of the twentieth century, more immigrants by far landed from trans-Atlantic steamers than had succeeded in reaching America in the two and one-half centuries preceding the year 1850. In addition to this immigrant traffic it is also the greatest travel route of the world and the greatest freight route, and consequently the route possessing the largest, fastest, and most complete ships that ever floated.

The North Atlantic traffic has always been of a dual nature The emigrating European has been finding a home, and the manufacturing European has been finding raw materials. This has given to the passenger and freight traffic a continual condition of unstable equilibrium There are more passengers moving west than east, there is more freight moving east than west Thus, there are, with the exception of certain short seasons of the year, unused passenger accommodations on the steamers setting out from America, and there is never even a temporary respite in the movement of empty

freight vessels from Europe for American cargo America has been sending raw materials in great bulk—cotton, wheat, corn, meat, lumber, copper, and cattle foods—and receiving manufactures of much smaller bulk. This was true in the first days of the Virginia colonists, tobacco ships, grain ships, and lumber ships; and, in the last decades, American manufactures have added a new class of traffic, chiefly bulky products of wood and steel Many vessels return with no cargo whatever except worthless ballast

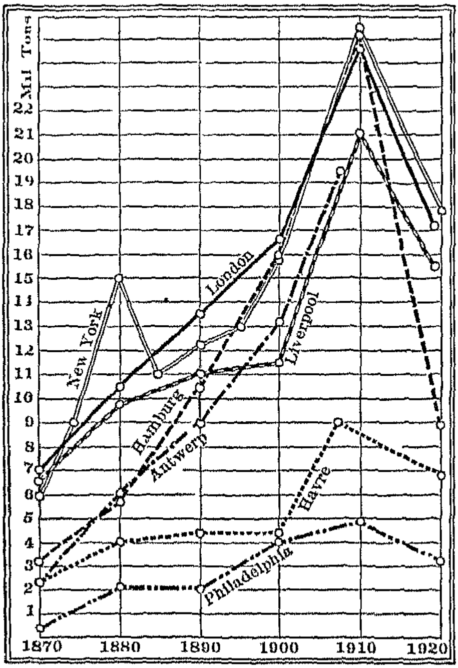


Fig 347 —The growth of world commerce. (After J Paul Goode)

This traffic, in ballast, which makes a load valuable for its weight only has brought us hundreds of thousands of tons of sand and stone of less than no value, but the necessity of carrying something has caused the Atlantic ships to bring at times coal, iron ore, iron, chalk, china clay, and such bulky freight from Europe at minimum cost as ballast substitutes (See British coal export in chapter on United Kingdom)

The traffic future promises that our freight movement will not increase so rapidly as it has in the past. America, with her increasing population and her great mills, is using more and more of the raw material, has less and less for export to Europe The fact that we are establishing manufacturing industries means also that we have a lessening demand for European goods, so both upon the side

of production and on the side of consumption there is a prospect of lessened dependence of America upon Europe, and relatively lessened demand for commerce upon the North Atlantic trunk route The emigrant traffic has probably been permanently

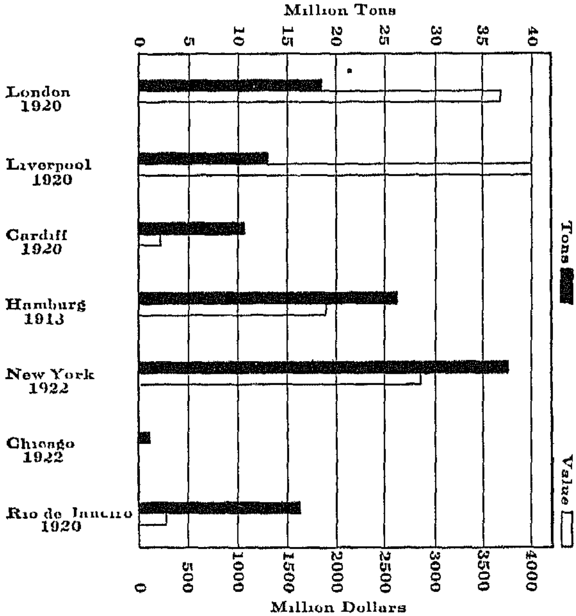


FIG 348 —Variations in the foreign trades of ports Comparison of net register tonnage and value of goods Cardiff is a port for coal and ores, Liverpool for cotton and manufactures (After J Paul Goode)

checked, but there is every indication of the steady growth of travel between the two continents

Ports. The great increase in trade during the quarter century before 1914 produced a multiplication of the lines of vessels, and consequently a great breaking down in the centralization that arose in the distribution and collection of the traffic to and from a few great ports which had been monopolizing it. There was a time when London and Liverpool almost monopolized the line traffic between Europe and America, but other cities rose to the position

of claiming their share from America direct rather than through the intermediate ports. Liverpool saw Bristol rise to the south of her, Glasgow to the north of her, and Belfast across the Irish Sea. London has lost trade through the rise of Antwerp, Hamburg, and Havre, which ports in turn have established coasting lines and have snatched from London a part of the distributing trade of Scandinavia and Russia. But this was not the end. The establishing of coasting lines was scarcely complete at Hamburg and Antwerp, when the same process went further, and yet another set of rivals arose. There sprung up a direct trans-Atlantic connection that gave to Hull, Copenhagen, Stockholm, Leningrad, and Bordeaux the ability to get some of their goods without dependence upon either the new intermediaries, Hamburg or Antwerp, or the old intermediaries at London or Liverpool (Figs. 347, 348).

A similar development has occurred on the western end, where New York, while increasing the annual amount of her traffic, is proportionally losing trade to her rival ports like Montreal, Boston, Baltimore, New Orleans, Galveston, and Mobile.[1]

[1] American shipping ports handled nearly 126,000,000 tons of freight, exclusive of coastwise commerce, during 1923, according to a survey of water-borne traffic, made by the U. S. Shipping Board's Bureau of Research. More than 55 per cent of this total passed through six ports. New York led with 27,600,000 tons, and next in order were Los Angeles, 11,495,000, Baltimore, 8,300,000, New Orleans, 8,290,000, Philadelphia, 7,870,000; and San Francisco, 5,740,000.

The following cities also handled more than a million tons of inbound and outbound freight other than in coastwise traffic in 1923:

Boston, 3,604,000; Buffalo, 3,336,000, Galveston, Tex., 2,893,000, Port Arthur, Tex., 2,854,000, Norfolk, Va., 2,126,000, Seattle, Wash., 1,949,000, Portland, Oreg., 1,719,000, Newport News, Va., 1,499,000, Cleveland, Ohio, 1,403,000; Fall River, Mass., 1,270,000; Tacoma, Wash., 1,243,000; Mobile, Ala., 1,219,000, Baton Rouge, La., 1,155,000; Toledo, Ohio, 1,132,000. and Perth Amboy, N. J., 1,080,000.

Of the total of 126,000,000 tons, 73 per cent, or 92,000,000 tons, represented United States trade with foreign countries, 25,000,000 tons was the traffic handled by Pacific ports and Atlantic and Gulf ports in intercoastal trade, and 9,000,000 tons the volume of trade with contiguous United States territory.

CHAPTER XLV

THE NORTH PACIFIC ROUTE

The commercial newness of the Pacific. As late as 1840 a man of international reputation stood up in the United States Senate and ridiculed the idea that the Pacific Coast of what is now the United States could ever be of value. It is from the middle of the nineteenth century onward that the Pacific has risen swiftly to the important place it now holds in the attention of the commercial world. In 1846 we annexed California In 1848 came the gold discoveries in California and the making of a new commonwealth there promptly followed. In 1851 the gold cry went up from Australia and there was a rush to that corner of the Pacific In 1854 the ports of Japan were opened to the world, 15 years later our first trans-continental railway was completed to the Pacific Coast, and since 1850 we have had continual interest in the North Pacific fisheries

Since 1890 the intensity of interest in the Pacific has increased In 1894 came the Japanese-Chinese War, which signified that there was an Asiatic power. In 1897 the Alaska gold discoveries placed emphasis on yet another point. We have become possessed of the Philippines and Hawaii, have watched the Russo-Japanese War, and all the leading powers of Europe strove for 20 years to gain a foothold in China, the mysterious Celestial Empire that has proved so inviting to the exploiting and trading nations. And the United States dug for a decade at the American isthmus creating the Panama gateway to the great Pacific (opened 1914).

Two steamer tracks. All the recent interest centers around regions which are directly connected with the North Pacific trade route This route is like the North Atlantic route in that the great circle helps to locate it, and widely separated regions are brought by the factors of geography to use the same great route. Instead of America and Asia facing each other across a wide ocean, a globe shows that, because of the great width of the Pa-

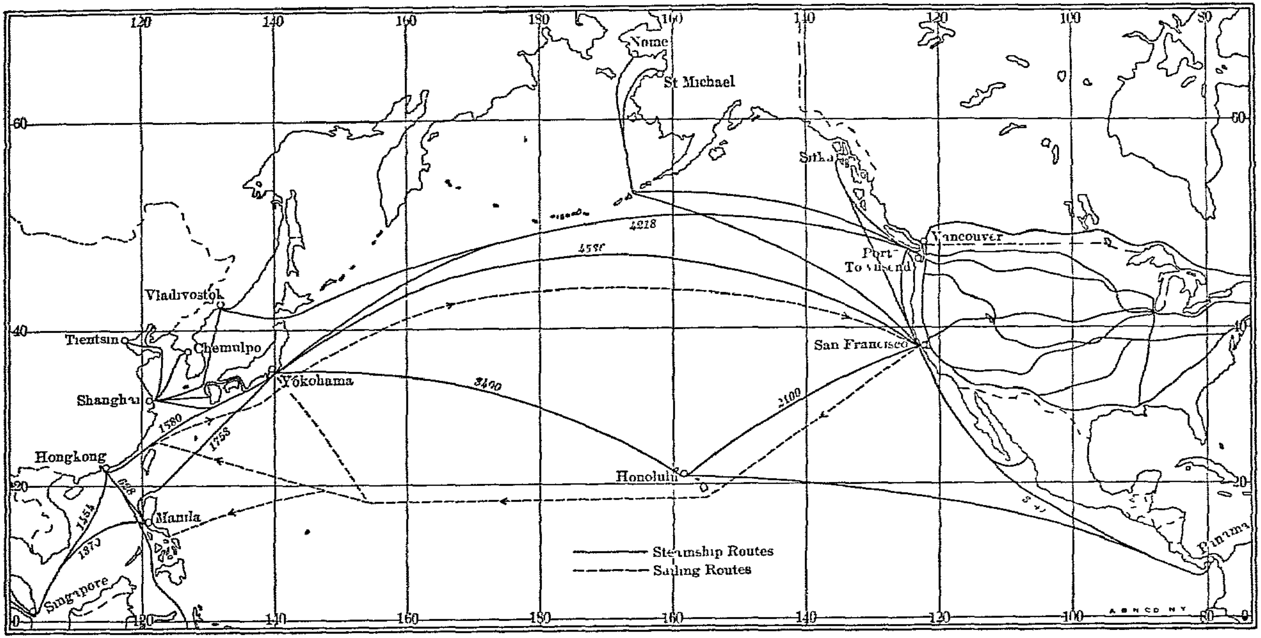


Fig 349 —Routes of the North Pacific

cific, the west shores of America and the east shores of Asia are almost a continuous straight line. The steamer that attempts to pass directly from the ports of Puget Sound to Yokohama will wreck herself upon the rocky shores of the Aleutian Islands.

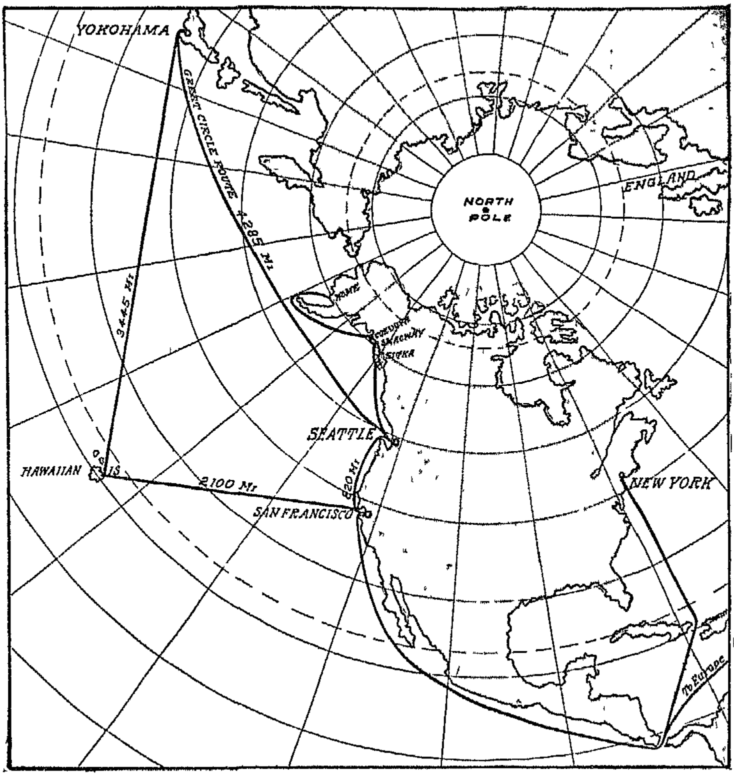


FIG 350.—Most of our maps make us forget that the world is a sphere, and they hide the real directions that places are from each other—especially places in high latitudes. The north Pacific distances are a good case in point.

Consequently the route is not a true great circle, but is flattened out to the southward from it, so that vessels may avoid the Aleutian Islands, in sight of which they pass. From San Francisco it is possible for the vessels to make a true great circle up

near the Aleutian Islands. The effect of the great circle becomes yet more perplexing when the attempt is made to apply it to the route from Panama to Yokohama The direct line between these two points goes northwestwardly through the Caribbean Sea, Yucatan, the Gulf of Mexico, Texas, Wyoming, Vancouver Island, the Alaska peninsula, and thence southward to Japan. A steamer compromising with these hard facts skirts the shores of the American continent until southern California is reached, and then across the North Pacific Ocean in the latitude of southern Canada San Francisco is therefore much more nearly upon the actual short route from Panama to Yokohama than is Hawaii, which we are accustomed to think of as being exactly in the path To stop at San Francisco would require a deviation of but 114 miles from the shortest possible steamer path and the deviation to Hawaii is over 300 miles. The one point that commercially commands the North Pacific route is the main island of Japan, for upon it is the great port of Yokohama, where practically every vessel crossing the north Pacific stops Here every thread of this great commercial cable is focused to a single point This spot is exactly on the route and is a great coaling station, being thousands of miles from any other port to the eastward which can have rendered service to the steamer Manila is the last port of call for the steamers passing from America to Asia, Yokohama is directly on the route to it; and the Chinese ports of Hongkong and Shanghai are almost invariably sought by the same steamers on the out voyage (Fig 349, 350)

Coal supply. The coal supply upon the route is fairly satisfactory, but the great length of the voyage requires that a steamer shall give up a comparatively large proportion of her space for coal purposes. There is practically none taken en route. Fortunately the Japanese coal, lying as it does part way between Asia and America, is admirably located close to the ports Unfortunately there is no satisfactory supply thus far in California, and most of the American coal comes from the region adjacent to Puget Sound Some Japanese and more Australian coal is imported at San Francisco, and for many years before the opening of the Panama Canal cargoes of coal in sailing vessels regularly came around the Horn from Atlantic ports of America and occasionally from Wales.

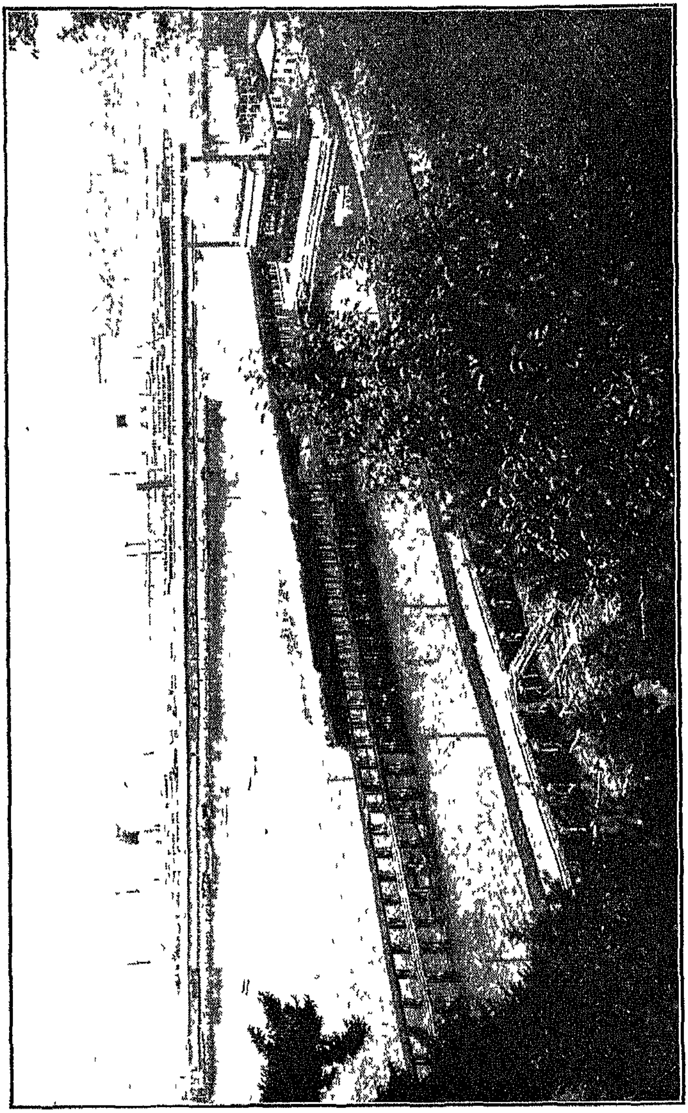


FIG 351 —Great Northern Railway terminal on Puget Sound

Traffic. The first part of the North Pacific route to attain modern importance was the link between Panama and San Francisco in the early days of the gold epoch in California. Many thousands of men engaged in producing nothing but the precious metal of coinage required a relatively great movement of commodities to supply their every want Sailing vessels flocked around Cape Horn with supplies Steamship lines were running from San Francisco to Panama and Nicaragua several years before the opening of the Panama Railway in 1856 The completion of the Union Pacific in 1869 gave quicker communication with the eastern centers of population

The North Pacific route has rendered its greatest service as a new road between the West and the East—a new rival to the old routes across Asia, around Good Hope, and through Suez Before the first trans-continental railway was opened in 1869 there was a steamer line from San Francisco to Japan and China This original line has been followed by a half dozen more. These numerous steamers, which are among the largest in the world, carry outward a much greater amount of cargo than they bring on the return voyage from Asia (Fig 351) A comparison of staples easily explains the reason. America exports coarse cotton cloth and gets silks in return; coarse lumber is exchanged for lacquer-ware, raw cotton for raw silk, canned goods and flour for drugs and essential oils, heavy machinery and petroleum for matting, Oriental art goods, and firecrackers

The lack of freightage balance upon this trade route has led to some peculiar movements Vessels coming out to China and Japan are in a sad plight for return cargo, so that many of the sailing vessels going to China and Japan from the North Atlantic ports have discharged their cargoes (chiefly oil) in the Oriental port, crossed the north Pacific in ballast and returned to the North Atlantic via Cape Horn with a cargo of grain secured at Puget Sound, Portland, or San Francisco Bay Shortly after 1900 British line steamers continued their voyage from Great Britain to Japan by crossing the Pacific to Puget Sound, loading there with grain and other American produce, which was taken to Liverpool by way of China, Japan, and the Suez Canal before the Panama Canal was opened Since the opening of the

Panama canal it is common for vessels to go around the world and such line service is regularly advertised

Hawaii and Alaska. Hawaii has a place in the traffic of this route much greater than her area would indicate The Hawaiian staple is sugar, which has reached quantities exceeding 600,000 tons a year. Hawaiian sugar went around the Horn until the opening of the Tehuantepec Railway Much of it goes to the port of Philadelphia, although some of it goes to the nearby ports of the Pacific mainland, which are also importing bananas, pineapples, and other tropical fruits from these islands The frequent service from San Francisco gives that city an even greater importance as a base of Hawaiian supply than as a market for Hawaiian goods

To the northward there is an additional stream of traffic To supply the gold and fishing industries of Alaska, vessels pass both from San Francisco and Puget Sound, although the latter, because of its nearness, has a larger trade and a route which lies largely within the shelter of the archipelagoes that skirt the shores in this region

Prospective traffic. The prospects are for great increase of traffic along the North Pacific route. Every region adjacent to it is, in the modern sense, in its economic infancy The chapter on China, Japan, and Korea showed the vast human and material resources of the Orient Any industrial awakening there must mean enormous traffic over this route

There is also indication that the mineral resources of Alaska are of large extent, requiring much import of machinery and other supplies from the South. Every trans-continental railway has some kind of trans-Pacific steamer connections at its western terminus, and long in advance of the date of completion incompleted lines in both Canada and Mexico have had contracts for new Pacific steamer lines to follow the common track to Asia One of these ventures was a failure, partly or wholly due to the Mexican wars of 1911–24 A railroad was partly built from Kansas City to Topolobampo on the Gulf of Lower California, with contract for a trans-Pacific service.

CHAPTER XLVI

THE SUEZ AND PANAMA CANALS

Going around the world is usually a patchwork of several different journeys for the travelers, and until 1914 it was an unusual thing for ships to make a complete circumnavigation. Now, since the opening of the Panama Canal it is easy and common.

It was fortunate for commerce that the chance of nature so nearly cut the earth in two at its middle that we could finish it with canals. The Suez Canal (opened 1869) relieved the trade between the West and the East of a long and wearisome journey around Africa or an expensive portage at Suez. Before the canal was opened, thousands of camels transferred burdens between the Mediterranean and Red Sea steamers. The distance and scarcity of coal on the Good Hope Route restricted it at that time almost entirely to sailing vessels. About 1890 freight steamers began going to Australia that way while the mail steamers used Suez. The difficulties of the Red Sea have always kept the sailing vessel away from the Suez Canal, and it still rides around Africa before the unusually favorable winds that sweep the Atlantic and Indian Oceans (Figs. 352, 353).

Judged by its relation to the earth's land mass and to the numbers of people served, the Suez Route goes through the heart of the world. It reaches lands containing most of the world's population. For Asia the total is 800 million, for Europe it is 400 million; for Atlantic North America it is over 70 million, and Africa contributes enough to raise the total of the people served by this route to over 1,300,000,000—an astounding figure—more than three-fourths of the world's inhabitants. The only large masses of population that are not reached are the blacks of Central Africa and the forty odd millions of South Americans.

While the American isthmus blocked access to the Pacific, that ocean was in a sense a sort of blind alley as evidenced by the tremendous journey made by vessels that went from London to Yokohama and Puget Sound and then turned to retrace their

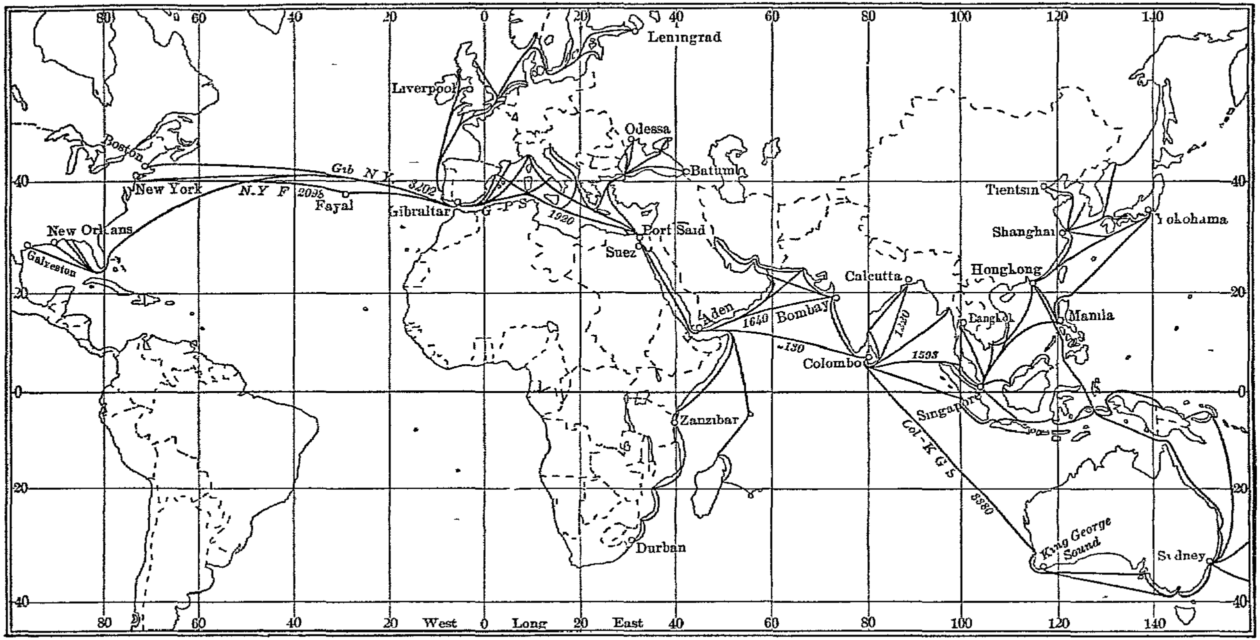


FIG 352 —Mediterranean Asiatic route

tracks. To-day the short cut home for that vessel is by way of the Panama Canal, thus completing a round-the-world voyage which has become typical Europe's ships can go out to the Orient loaded and return (see chapter on North Pacific) with cargoes from the west coast of North America. Los Angeles and San Francisco are now ports of call between New York, Europe, and the Orient

The Panama Canal is now handling much inter-coastal business Fourteen lines are now handling this business through the Canal A western man stated that the Panama Canal made the west coast of America into a real world empire, instead of an isolated province Similarly the liner on the west coast of South America can circumnavigate that continent, coming or going by the Canal as circumstances warrant.

The Canal affords a great relief (see table of distances, appendix) to the trade of the United States Pacific Coast with Atlantic ports, which had long been compelled to pay high costs for transshipment at Panama, or go around Cape Horn, the longest journey in the commercial world Wheat from the interior of Canada may (and does) reach Vancouver by rail and Liverpool by steamer. The trade of New York and New Orleans with Australia also has much distance to save by the Canal Even greater is the saving from the Atlantic ports to the Orient. The steady procession of nitrate ships and ore ships, mostly tramps, from western South America uses the Canal, but the tramp makes varying use of the new waterway. If freights are high it will be more profitable than when freights are low. Thus a ship may be making $25 or $250 per day, facts which would make her owner have differing regard for the canal tolls which might cost him $100 per day for the time saved

These two canals have done much to enable the tramp and liner alike to get quickly from traffic zone to traffic zone and economically serve the world The opening of each has been a world influence. Upon the opening of the Panama Canal there was no continent, almost no important country even, that did not find a rearrangement in the routes by which some of its goods go and come by sea. To their great relief, steamship lines by the score rearranged their itineraries, and the tramp freighters by hundreds and thousands found themselves unloosed from

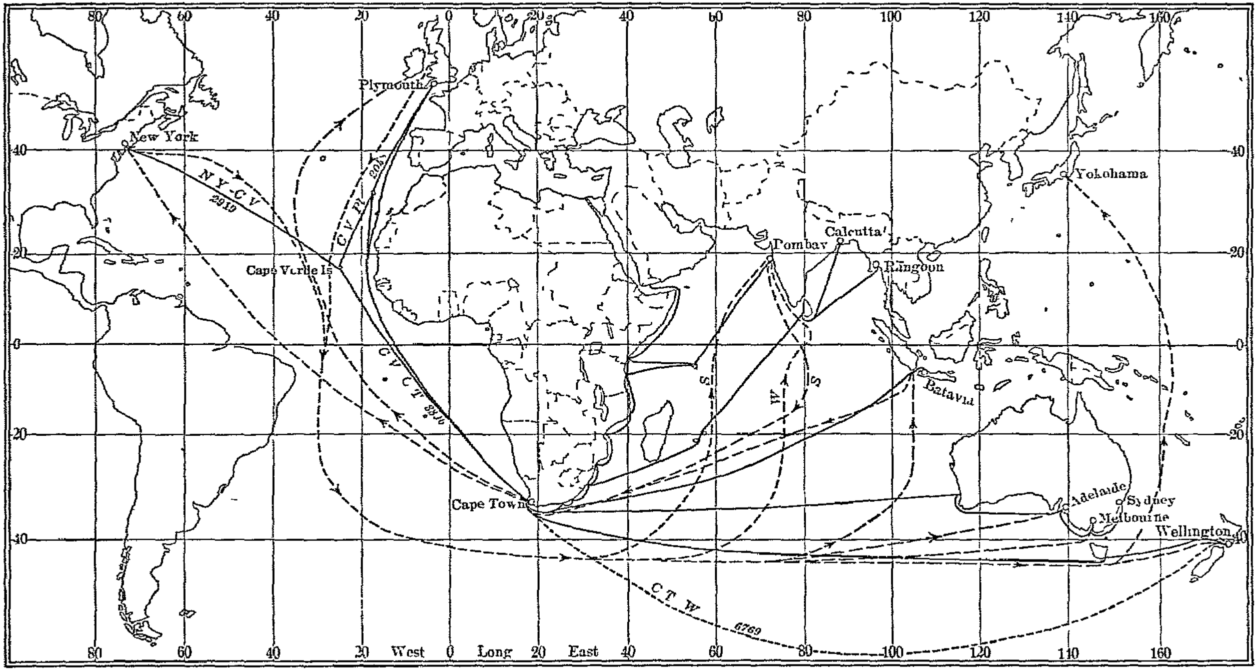


FIG 353 —The Good Hope route

harassing restrictions and free to work their way around the world with a freedom that redounded to the benefit of hundreds of millions of men. The start forward to this, the greatest readjustment of all time, was not unlike the general movement that follows the signal of a policeman in a crowded street when he releases two masses of waiting men or vehicles after a parade has passed.

Questions

1 Which of these canals is nearer to good coal shipping ports?

2 What Oriental city is about equi-distant from New York by either canal?

3 How does the ocean freight rate make the tramp ship more or less dependent on the canal?

4 What facts about Pacific traffic make vessels circumnavigate the globe?

CHAPTER XLVII

WORLD TRADE DURING AND AFTER THE WAR

To understand world trade, and especially American trade in the period following 1925 we need to understand what happened during the World War and see the significance of this remarkable disturbance of trade.

The war had its unbelievably bloody battles, but it was also a war of goods—(*a*) equipment, (*b*) food, (*c*) transport.

(*a*) Equipment. We get some measure of the importance of equipment in this war when we recall that in November, 1914, after the deadlock on the western front and the digging-in of the armies Lord Kitchener, head of the British armies, announced that the war would last three years. He underestimated it by a twelvemonth, showing that even he did not realize how much time it would take to make the thousands of big guns, the millions of shells, the shiploads of explosives, the tens of thousands of motor trucks, and the other masses of material of which the mere enumeration gets us into figures beyond our understanding. The retailing of these goods in the United States in the post-war years was a continual astonishment as to how so much could have been made.

The United States, with its one hundred million people, its matchless and abundant resources, its machine shops and factory organization, spent four busy years making munitions for this war. Every European neutral was equally busy and the warring countries exerted themselves to the utmost.

(*b*) Food. When Germany closed the Baltic Sea and, by getting Turkey into the war, closed the Bosphorus, she shut western Europe off from her chief import supplies of bread and forage grains. This threw added burdens on the American market and it enlarged the wheat fields and corn fields of American farms. The people of Western Europe were so busy with fighting that they did not have time to plow and raise forage for all of their

animals, so the demand fell upon America also for meat, and we increased our flocks and our exports of meat.

(*c*) Transport. The war was as much a war of transport as it was of men and of munitions. The fleets of motor trucks that ground up the roads of France until they had to be rebuilt time and again came by the trainload from American factories and clogged American ports. The sinking of ships by the submarine put us to feverishly building a navy and created the greatest burst of merchant shipbuilding ever seen. These trucks, these ships, this meat, this bread, these munitions, were all sold to Europe at unheard-of prices, and as a British official remarked to me in the fall of 1917, "You have here in America all the money in the world," and he was not far from right.

Europe had indeed imported and America had exported to the limit, indeed, beyond any limit that the world's financiers had before thought possible. Before the war we had regularly exported a few hundred million dollars a year (Fig. 355) more than we imported. This surplus, commonly called a favorable balance of trade, was made up as follows:

1. Interest due the people of Europe who owned stocks and bonds in American enterprises.

2. Payment of freight to European shipowners who carried our goods and our travelers. Most of our commerce and trans-Atlantic travelers were carried in foreign ships.

3. Excess of travel expense, because the amount of American travelers' expenses in Europe exceeded the amount of European travelers' expenses in America.

4. Money taken back by Europeans who worked here for a time and returned. Also money sent by new immigrants back to their old homes in Europe.

Because of the war our balance of trade jumped up to an extent never before seen. Europe imported beyond belief and her exports melted away. She was too busy fighting.

The chart of balance of trade shows how astonishingly Europe bought without sending us goods in return. Instead of sending us goods as is the habit of trade, they have given us promises to pay at some future time. First the British and French governments paid for these goods by giving their bonds (promises) to American individuals (bankers). When this had about reached

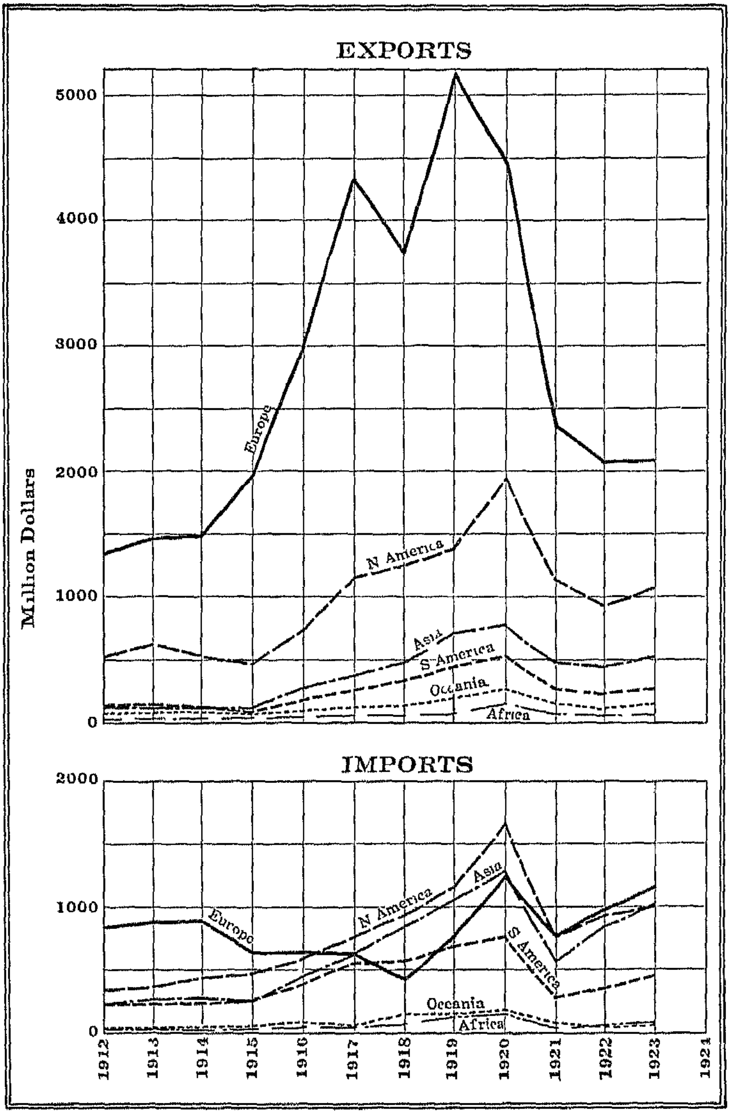


FIG 354 —United States exports and imports by continents

its limit, the United States government borrowed the money from the American people (Liberty Bonds) and loaned it to the British government, which paid for our corn and iron with these credits.

It was the Liberty Bond that finally pushed up our foreign trade in 1917 and kept it there during 1918 and 1919. Such unnatural trade without real payment must be temporary. Real goods must follow promise Unless the debt be forgiven, the Europeans must pay the interest on their bonds and they must some day pay the bonds themselves. To do this they must resume their industries and their trade They must sell goods to get money with which to pay

The period of readjustment. In this post-war period many countries including the United States are on an entirely new basis of international trade The basis of American trade is changed profoundly in four respects:

1 The German indemnity
2 Europe's increased ability to compete in foreign trade.
3. The changed balance of trade
4. The change of price basis

The German indemnity. We cannot understand the prospective trade situation until we see what it means for Germany to pay the Allies for some of the billions worth of property that she destroyed

Through her indemnity payments, Germany may decide the export surplus and the foreign trade condition of many countries If they compel her to pay for the war destruction or the war costs or both, she can at the start borrow a little money in neutral countries to get upon her feet She did this some immediately after the end of the fighting, and a new loan to Germany was part of the Dawes Plan of 1924 This was merely to give her a little start Of course, it increased Germany's total debt, the amount she had to pay

When it comes to paying these debts Germany can pay foreign nations in only one way—by producing goods, export goods If she had all the gold in the world, other nations would have no money, and it would only be a drop in the bucket anyhow What then? Goods The facts of trade tend to make us forget that gold, like bank checks and all other money, is but a *medium for the exchange of goods.* The only exception is when the

gold happens to be the product of a mine in which case it is goods, like coal, for the country first producing it Countries settle trade differences with gold, but they can only get the gold by digging it out of the ground or buying it with goods As

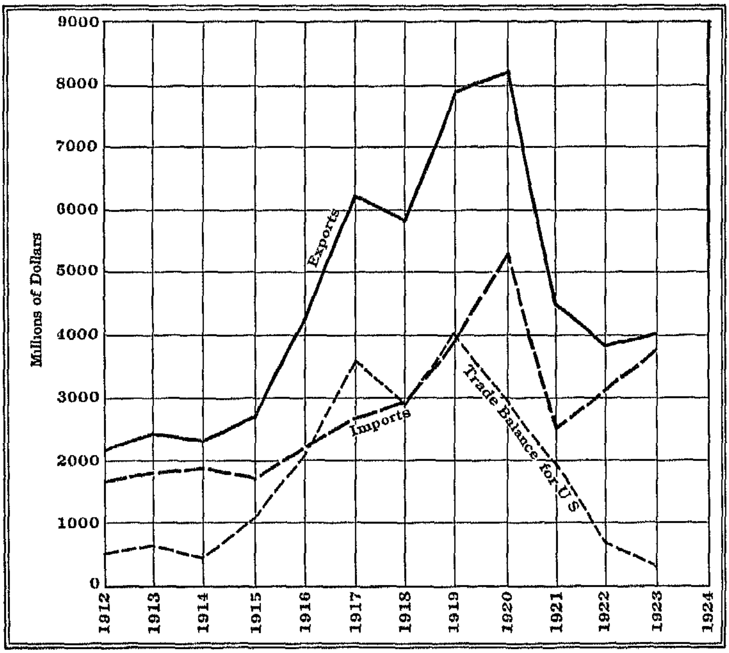


FIG 355 —United States total trade with the world

Germany is not a gold producer, she can only get it by buying it with goods—exports

The Allies wish to make her pay for the war How may it be done? With regard to war settlement, Germany may pay in two different ways:

(*a*) The payment of money which results from exporting to the world market, carrying freight in ships or caring for foreign people (travelers) in Germany.

(*b*) The payment in produce directly to the receiving countries.

(*a*) Money payment This merely means exports, selling goods abroad, the purchase with goods of bills of exchange on banks in London, Paris, Brussels, or New York, and the handing of these bills to the representatives of the collecting country. By this process, Germany may send the goods to neutrals and transfer the credit to England or France, as by sending cloth and machinery to Argentina to pay for wheat and meat that went to England or France That is the way France paid Germany in 1872-3, chiefly in bills on London, but it was paying none the less in exports, of which France showed at the time a distinct surplus over imports To get the bills on London, the center of international financial transaction, she sold goods in other countries Germany, receiving all these credits, showed a financial inflation and speculation which according to many authorities helped bring on the panic of 1873, and made its effects in Germany much more severe than in France

Because of war settlements Germany may be compelled to show an export surplus of hundreds of millions of dollars per year for a term of years If she does do this other countries will find it difficult to do the same thing at the same time, for Germany will by this process become a country of low prices, therefore, a country of low wages, a country without luxury It will be most difficult for countries with higher prices and higher wages to compete with Germany in neutral markets on commodities where the competition is even, as in chemicals, textiles, standardized machinery, and many other metal manufactures The United States and the Allies will have high prices due to the inflation of war loans (Liberty Bonds, etc.) and the increased money on hand from German payments That difference was noticeable between Great Britain and the United States in 1923 and 1924 after England began payment to the United States of 150 million dollars a year interest on the money the United States had loaned Great Britain during the war

At the time of the French occupation of the Ruhr in 1923, there was much friction between England and France, even the fear of war, and the cause of it was the different attitudes of the two countries toward German payments France, having small foreign trade, wanted Germany to find the money and pay. England, having a large foreign trade, and depending on it for her

economic life, did not want anything done that would interfere with her chance to trade with Germany nor was she keen to have Germany capture her trade with other countries as she would have had to do to make heavy payments to France. All countries having inflated currency are extra good markets for German goods with which Germany will get credits to send to London and Paris to pay the war debts of those countries The effect of this price difference between the countries where gold is plenty, as in the United States, and in the countries with depreciated currency was glaringly shown during the period of the decline of the German mark from 23 cents to nothing, 1918–1923 American department stores sold for several dollars[1] things that cost only a few cents (American gold) in Germany.

This is an extreme case, but it illustrates the situation that will prevail in international trade while Germany is paying She will in a sense be giving the goods away and the rest of the world will be trying to sell them in competition with her The result of such competition is plain It will make a lower price level throughout the world, because it will increase supplies and large supplies always tend to reduce prices also After 10 to 20 years of paying for restoration, Germany will have the greatest export trade ever seen except our World War trade She will have had to build up a trade first to get the credits to pass to her enemies. Her enemies will have the credits, but Germany will have the trade

Some people are much alarmed at this prospect A part of this fear arises from the widespread belief that exports are necessarily a fine thing for a country and imports necessarily a bad thing This 18th century idea called mercantilism was held so strongly by Napoleon Bonaparte that he freely permitted England to import grain from the Baltic in 1810–11, thinking that he was thereby injuring her. Really he let England strengthen herself to crush him

If we look at it in its simple economic light, this payment looks good, very good. For a term of years, Germany becomes the servant of other nations to the extent of billions of dollars' worth of goods which she produces and sells for their account, turning

[1] No newspaper would publish this finding of a Senate Document for fear of losing department store advertising

the money over to them—wealth, national wealth. That certainly looks good. It would undoubtedly help in the payment of national debts. England and France would hand money over to their citizens in exchange for bonds and interest on the bonds. The people would take this money and buy things, German things perhaps. The Belgian Government might pay for the borrowed bread the Belgian Relief distributed through the terrible years of the war.

Here is the place where we must deal with the distinction between the Government and the citizens of the country. There are two kinds of danger in this situation—one industrial and the other financial. The industrial danger lies in the possibility of a country living on this restoration fund for a time and getting out of the habit of supporting itself so that when the payments end it would be in the position of the rich young man who had lived on his father's money while it lasted and had not learned how to support himself when it was suddenly gone.

If the people of the fund-receiving country could keep up their work and their industries just the same this difficulty would not arise. This, however, is very difficult or impossible. Germany *must* sell and others will have difficulty in competing. That fear haunted England during the early post-war years when she continually had hundreds of thousands of unemployed because impoverished Europe could not buy her produce as before the war. Here is a point where the financial danger of the restoration payment aggravates the industrial danger. It may tend to increase speculation and panics in the receiving countries as did the French payments to Germany, 1871–73.

There is little doubt that the receipts of hundreds of millions a year of foreign credits by England, France, Belgium, and Italy will be a menace by making speculation, inflation, and panic that will require a careful and vigorous control of governmental finances already over-inflated with war loans—paper money in fact. It will tend toward financial depression, with its unemployment, the greatest ogre of this industrialized world. Undoubtedly one part of this financial control should be a continued, careful inspection and licensing of capital issues in all the countries receiving German money and probably in the United States also. Such a reform is already under discussion in the United States. It is much needed.

The ultimate industrial danger in the German restoration fund is that Germany will finish her payments with a huge industry and thoroughly established trade outlet for that industry, while the Allies have neither the industry nor the outlet This danger, if it is a danger, can be partly avoided by having the payments on the fund taper off, after a time declining at a small percentage each month until it gradually disappears Under no condition should the rate of payment be left to Germany In 1871–73, France got Germany on the hip by handing her money faster than she could digest it, and if Germany were free to pay as she chose she might play hob with world finance

The gradual ending of the payments would let international trade and industry make general adjustment to the great change, so that its ending would be unnoticed

Gradual ending would also dovetail with a process of foreign investment The restoration fund should be and probably will be largely invested in foreign lands German cloth, cement, machinery, glass, paper, and general consumption goods may now go to Spain for French and Belgian account, and let French and Belgian financiers resume the work on hydro-electric, irrigation, power, and public services enterprises that stopped so suddenly in 1914 when French and Belgian supplies were cut off by war paralysis, and the American engineers who were doing the work were sent home The building of a railroad in Brazil means that somebody furnishes equipment of the road and the goods used by the men and the families of the men who do the work of building the road Thus Germany will build a railroad in Brazil for English account by sending cars, rails, steam shovels, dynamite, cement, and locomotives to Brazil. She will also send clothing, shoes, pocket knives, playing cards, phonographs for the men and also gasoline, tobacco, flour, and bacon, mules and bales of hay which she may secure in the United States, Argentina, and Brazil by sending potash to those countries The financial records of the transaction will be certain pieces of paper, bills of exchange, written in terms of gold. Thus the surplus exports which produce Germany's restoration fund may be used to equip enterprises in Russia, Brazil, and even the United States for the account of English, French, and Belgian investors While the railroad is being built it will make prosperity in Brazil and

in the countries that supply the materials, but the English and Belgian pick and shovel makers, rail makers, locomotive and car builders may be idle because Germany, driven by indemnity, has taken their export trade. At the same time English and Belgian and French *investors* may own this Brazilian railroad which they have built by buying German supplies and hiring Brazilian laborers. When the railroad company pays dividends, the interest money will go back to England and Belgium as imports. The income from these investments should gradually mount as the annual payment of restoration money declines, so that its ending would be unnoticed. The period of payment must end, however, with Germany possessed of large producing capacity and large export, while England and France will in all probability have relatively small export and large import—this surplus of imports meaning, of course, that the nations were rich with foreign investments on which they were receiving returns.

Europe's increased ability to compete. Europe lost millions of workers during the World War, but their producing power has been much more than replaced by improvements in the mechanical power and industrial organization that the goad of war necessity and war profits forced upon European industry. Europe's changed industrial basis may be summarized under two points:

(*a*) She has increased her use of agricultural machinery which she had delayed adopting because labor was cheap and abundant.

(*b*) She has learned to utilize the three American wonders of standardization, specialization, and mass production.

To understand these three words which have for the last twenty years characterized American industry, and which refer to processes that Europe has now learned, we can look at the building of a wagon a generation ago. The wheelwright took his hand tools and shaved the spokes, turned and chiseled the hubs, sawed and trimmed the felloes. Perhaps his one helper fashioned the bed and the running gear, but the wheelwright himself knew how, from start to finish, to make a wagon, and he often did it. Now two to three machines combine to make the spokes, other machines make the hubs and the felloes. The bed is chopped out by standardized wood-working machinery. Each piece is made by a specialist, and the wagon-maker puts them together as a child does a house of blocks. This is typical of the revolution which has given us the

age of cheap machinery. This standardization and specialization have given us those miracles, the dollar watch, the Ford automobile, the phonograph, the telephone, and placed them all within the reach of the average citizen

Specialization and standardization are so much cheaper than the old-fashioned made-to-order-way because they permit us to use the machine tool This is the age of the machine tool, which has replaced in wood-working the various hand tools of the carpenter, and in metal-working the various hand tools of the machinist Reduced to their lowest terms, the wood-working and iron-working processes are similar, and the elementary processes are few The artisan bores holes, he shaves or planes, he saws, he turns in lathes, but the machinist or factory wood-worker of to-day does none of these things himself If he wishes holes made, he puts a piece of wood or iron in a boring machine, if he wishes it smoothed, he puts it in a planing machine No matter whether it be wood or iron, steel or brass, the process is the same with machines made to do the work in an infinite variety of sizes, shapes, and materials The expert machinist, the old-style machinist, can take any kind of a machine and do any kind of work, but he is now as much out of date as the man who can make a watch or wagon from start to finish.

It is wasteful for one man or one machine to do many kinds of work The reason of this is that the machines are elaborate, they must be adjusted and set for each kind of operation that they perform Thus the setting of a machine to do a piece of work often takes more time than the actual doing of the work Sometimes it takes a half-day to reset a machine Sometimes it takes a week It may take ten minutes to work up one piece after the machine is set. Thus the costs of shaping a particular piece of metal were, for one piece, 25 cents, for two pieces, 15 cents each, for 5 pieces, 10 cents each, for 100 pieces, 5 cents each, for 500 pieces, 3 cents each. Now we see why it is so much cheaper to make the valves for one of a hundred ship engines all alike, new style, than it is to make one or two for sister ships, old style, or worst of all for one ship.

Then, to cap the climax of this thing, these pieces made at such low cost are interchangeable, and will fit into any one of tens of thousands of machines of a certain type. It is by the utilization of these revolutionary processes, standardization, and specialization

that we have had cheap quantity (mass) production. By this process the Ford car, the dollar watch, and the American locomotive made by highly paid men, have been sold in competition with the produce of much more skillful men who work for lower wages but on the old unstandardized methods We also see why the Ford car did not change its design for years

We used this process before the World War and especially we used it during the World War. It enabled a bridge plant in Pittsburgh, a boiler plant in Ohio, a structural steel mill in West Virginia, and a plate mill in Illinois to specialize and adjust their machinery to make hundreds or thousands of duplicate pieces for hundreds or thousands of duplicate ships So an automobile plant here, a windmill plant there, an engine shop yonder, can make some of the parts of the marine engine and the rather numerous small machines that are needed in a ship, such as small engines to hoist cargo, pumps for water, pumps for oil, fans for ventilators, pulleys, cables, compasses

Standardize, standardize, specialize, specialize, turn them out by hundreds Thus did we build ships during the war Thus do we manufacture the cheap but efficient machinery that makes America famous.

The important point about this standardization and specialization and mass production is that the war has taught it to Europe It is no longer an American monopoly.

The making of munitions forced England, France, Germany, Switzerland, Sweden, Denmark, and Holland to make over their machine-shop industries until they had specialization, standardization, and mass production carried to the finest degree of perfection ever attained on this planet We boasted in America of our war industries, but the facts are that the European munitions plants did more accurate work and did it in quantity, and millions of workers were taught their simple parts in this copying of an industrial method first worked out in America

What does this mean in the foreign trade? It means that Europe can now compete more nearly on terms of equality with America in one of the points where we had a kind of pre-war industrial advantage, in some cases one might almost say industrial monopoly

As an example I may cite the case of a certain American safety razor which has long been advertised and sold at a price of several

dollars Exact duplicates of this razor made in Japan were sold in South Africa and elsewhere for 38 cents The American makers have withdrawn from the South African market They can do nothing there Japan is another country that revolutionized its industry during the World War.

In the matter of European use of the new factory system in this period of readjustment it should be remembered that technical education in Europe had been promoted more than in America, at least before the war

Balance of trade and price basis. Our new and amazing balance of trade piled up during the war is only a deferred payment. If it is a true balance it must be paid, and there is only one way to pay any large share of it—goods The long continuance of buying on promises had so disturbed international finance that at the end of the war a pound sterling was worth less than $4.00 in New York Thus $4 8665 worth of goods in America could be bought for less than $4 00 in London. This gives any nation whose exchange is low a great advantage when they sell in foreign markets in competition with the nation whose exchange is high. If the Belgian franc in theory worth 19 3 cents is only worth 10 cents it gives Belgium a low-priced market for South American or other purchasers. Our high price tends to keep us out of foreign markets at all points where there can be any competition

In summary, we may state that America has now reached a new period in international trade During the World War we had a golden age of export For four years nations begged us for goods We did not *sell* then nor did the purchasers pay for them We merely *let people have* the goods on credit Now they must give us the back pay in *goods*, the only thing in which payment can be made. We have large import trade due us The old period of heavy surplus of exports is gone—unless through European refusal to pay debts due us we find that we have been making presents during the World War instead of selling goods When it comes to continued selling abroad we find ourselves at a disadvantage in international exchange and with rivals who have new powers of competition and a new equality at the point where we had had something approaching a monopoly advantage There is a new era of trade ahead of us

STATISTICAL APPENDIX

INTRODUCTORY NOTE —Much labor has been given to bring these tables of statistics up to the most recent date for maximum efficiency Statistical studies and comparisons are still embarrassed by the World War which made ten years of industrial chaos and changed many boundaries, the entities of most statistical representation I present these figures as the best obtainable for the purpose in hand A vast deal of international trade, politics, and policy have their symptoms recorded in these figures and the careful student is urged to examine them

Persons desiring to go further into statistics or desiring the figures of the moment are referred to the following sources

I Statistical Abstract of the United States, published by the Bureau of Foreign and Domestic Commerce, and to be had free from your congressmen

II Yearbook of the United States Department of Agriculture for agricultural statistics (See congressmen)

III Yearbook of the United States Department of Commerce for commercial statistics

IV Mineral Resources of the United States, a large two-volume annual with very full accounts of Mineral Industries and Statistics of Mineral Production of United States (See congressmen)

V The Mineral Industry, McGraw Hill Co , does the same for all the world

VI. Atlas of Commercial Geology, United States Geological Survey, shows valuable maps and graphs of mineral productions

VII The Statesman's Year Book, The Macmillan Co , London, contains an excellent brief account of all countries, with many well-chosen statistics

J. R. S.

Columbia University,
March, 1925

TABLE 3 —DISTRIBUTION OF CLASSES OF CATTLE, 1924 (*a*)

What is the explanation of the different ratio of the different classes of cattle in the different regions?

	Milk cows, 1,000	Other cattle, 1,000
Populous East		
New Jersey	151	31
New York	1,628	393
Pennsylvania	1,071	486
Massachusetts	189	39
North Central Dairy Belt		
Michigan	987	611
Wisconsin	2,217	858
Minnesota	1,674	1,276
Cattle-fattening States		
Kansas	732	2,537
Missouri	793	2,063
Range States		
Texas	1,063	5,597
Arizona	46	1,092
Wyoming	48	793
Total United States (*a*)	24,675	42,126
Europe		
Netherlands (*g*)	1,085	977
Germany (*b*)	7,596	9,057
Denmark (*c*)	1,339	1,198
Canada (*d*)	3,746	5,974
New Zealand (*e*)	2,003	1,478
Australia (*f*)	2,343	12,098

(*a*) Yearbook, U S Dept Agr , 1923, p 880
(*b*) Commerce Yearbook 1923, p 583, figures for Oct , 1923
(*c*) Figures for 1923
(*d*) Statesman's Yearbook 1924, page 281 Figures for 1922
(*e*) Furnished by British Consulate General, New York Figures for 1923
(*f*) Furnished by British Consulate General, New York Figures for 1921
(*g*) Furnished by Consulate General of Netherlands, New York Figures for 1921

TABLE 4 —INTERNATIONAL TRADE IN DAIRY PRODUCTS, 1922

The United States, a great agricultural country, imports cheese while Switzerland and Canada export it Why?

Exports			Imports		
Country	Butter, million lb	Cheese, million lb	Country	Butter, million lb	Cheese, million lb
Argentina	52 3	14 4	Argentina		14 4
Australia	78 9		Belgium	41 7	48 1
New Zealand	125 4	130 0	Norway	7 6	1 5
Canada	21 5	120 1	Sweden	5 6	1 9
Denmark	210 5	19 6	France	64 9	60 2
Finland	18 3	5 9	Germany	2 3	51 9
France	6 7	22 0	Italy	2 9	15 5
Netherlands	50 9	143 7	Switzerland	15 0	1 7
Italy	1 6	32 0	United Kingdom	427 4	294 9
Switzerland		46 1	United States	6 9	46 5
United States	10 9	5 0			

Source Year Book U S Dept Agr , 1923, pp 920, 926

TABLE 5.—POPULATION AND DOMESTIC ANIMALS

What does this table show about meat prices since 1890? How has the change in the number of people in the United States changed the relative numbers of different classes of animals?

United States	Population, million	Cattle of all kinds	Per cent of population of United States	Milk cows	Per cent of population of United States	Other cattle	Per cent of population of United States	Hogs	Per cent of population of United States	Horses and mules	Per cent of population of United States	Sheep	Per cent of population of United States
		1,000		1,000		1 000		1,000		1 000		1 000	
1870	38 6	25,483	66	10 095	26	15,358	40	26,751	69	9,427	25	40 853	106
1880	50 2	33,258	66	12,027	24	21,231	42	34,034	68	12 930	25	40 765	80
1890	62 9	52 801	83	15,953	25	36 849	58	51,602	82	16,544	26	44 336	67
1901	77 0	62 333	80	16 834	22	45 500	59	56 982	75	19 648	25	59 756	77
1912	93 0	57 959	62	20 699	22	37,260	40	65 410	70	24 871	27	52 362	56
1914	98 1	56 592	57	20 737	21	35,855	36	58,933	60	25,411	26	49,719	50
1915	98 8	58 329	59	21,262	22	37,067	37	64 618	65	25 674	26	49 956	51
1916	100	61,920	62	22,108	22	39,812	40	67,766	68	25 752	26	48 625	49
1917	101 5	64,583	64	22 894	23	41 689	41	67,503	67	25 933	26	47 616	47
1918	102 8	67,422	65	23 310	22	44 112	43	70 978	69	26 428	26	48 603	47
1919	104 2	68 560	66	23 475	23	45,085	43	74 584	72	26,436	25	48 866	46
1920	105 7 (e)	68,369	64	23,619	22	44,750	42	71,727	68	25 826	24	47,114	45
1921	107 8 (6)	66,191	62	23 321 (o)	22	42 870 (b)	40	66 649 (a)	62	25 182 (c)	24	45 067 (d)	42
1922	109 2 (6)	65,632	60	24,082	22	41,550	38	57,834	52	24,523	22	36 327	33
1923	110 8 (7)	66,352	60	24,429	22	41 923	38	63 424	57	24,359	22	37 209	33

TABLE 5 —POPULATION AND DOMESTIC ANIMALS (*Continued*)

What does this table show about meat prices since 1890? How has the change in the number of people in the United States changed the relative numbers of different classes of animals?

	Population, million	Cattle of all kinds	Per cent of population of country	Milk cows	Per cent of population of country	Other cattle	Per cent of population of country	Hogs	Per cent of population of country	Horses and mules	Per cent of population of country	Sheep	Per cent of population of country
		1,000		1,000		1,000		1,000		1,000		1,000	
United Kingdom, 1922	47 2 (G)	12 170 (1)	26	4 607	10	7,563	16	3,834	8	2,028	4	24,166	51
France, 1922	39 2 (G)	13,749 (3)	35	7,304 (3)	19	6,445 (2)	16	5,196	13	2,778	7	9,782	25
Germany, 1922	59 8 (G)	16,653 (2)	28	7 596 (2)	13	9,057	15	17,226	29	3,651	6	6,094	10
Denmark, July 15, 1922	3 3 (G)	2,537	77	1,339 (4)	40	1,198	36	2,853	86	562	19	374	11
Switzerland, 1922	3 9 (G)	1,425	37	747 (5)	19	678	17	640	16	134	3	245	6

(*a*) U S Dept of Agric Year Book, 1920, p 753
(*b*) *Ibid* , 1920, p 729
(*c*) *Ibid* , 1920, p 723
(*d*) *Ibid* , 1920, p 743.
(*e*) Census of U S , 1920, Vol I, p 14
(*F*) U S Dept of Agric Year Book, 1920 pp 701–717
(*G*) U S Stat Abstract, 1922, pp 727–729
(*J*) *Ibid* , 1915, p 716
(*K*) *Ibid* , 1912, p 800
(*L*) These figures are approximately the same as those read from charts showing cattle and ("cows" or) milk cows in Cir 7 , June, 1919, U S Dept of Agric , "Trend of the Dairy Cattle Industry in United States and Other Countries "
(1) U S Dept Agric Year Book, 1923, p 1036
(2) Commerce Year Book, 1923, p 583, figures for October, 1923
(3) Bureau of Statistics, International Institute of Agriculture Rome, International Crop Reports and Agricultural Statistics, June, 1924, p 245
(4) Figures for 1923
(5) Figures for 1921, Commerce Year Book, 1923, p 595
(6) Statistical Abstract, 1922, p 646
(7) News *Bulletin, June 16*, 1924, Nat Bureau Economic Research, Inc

TABLE 6.—WORLD WATER POWER RESOURCES

A summary of the world's water-power plants and of the world's potential water power, by continents and by selected countries, in 1920 (U. S Geol. Survey)

	Developed horse power	Potential horse-power
North America	12,210	62,000
South America	424	54,000
Europe	8,877	45,000
Asia	1,160	71,000
Africa	11	190,000
Oceanica	147	17,000
Approximate Total	23,000	439,000
United States	9,243	28,000
Canada	2,418	20,000
France	1,400	4 700
Norway	1,350	5,500
Sweden	1,200	4,500
Italy	1,150	3,800
Switzerland	1,070	1,100
Germany	1,000	1,350
Japan	1,000	6,000
Spain	600	4,000
Mexico	400	6,000
Brazil	250	25,000
British Isles	210	585
Austria	205	3,000
Finland	185	1,500
India	150	27,000
Jugo Slavia	125	2,600
Russia	100	2,000
Belgian Kongo and Belgian mandate		90,000
French Kongo		35,000
China	2	20,000
French mandate in Kamerun		13,000
Nigeria and British mandate in Kamerun		9,000
Siberia		8,000
Argentina	25	5,000
Region of the Caucasus	5	5,000
Madagascar		5,000
New Guinea		5,000
British East Africa	1	4,700
Peru	36	4,500

TABLE 7.—WATER-POWER RESOURCES OF THE UNITED STATES

Very detailed figures of power development by streams and regions may be found in Statistical Abstract of the United States and an atlas, United States Geological Survey

Principal drainages	Drainage area, square miles	Flow per annum, billion cubic feet	Horse-power available	
			Primary or minimum of two lowest weeks	Minimum of six highest months
Northern Atlantic to Cape Henry, Va	159,879	8,942	1,702,000	3,186,600
Southern Atlantic to Cape Sable, Fla	123,920	5,560	1,253,000	1,957,800
Eastern Gulf of Mexico to Mississippi River	142,220	6,867	559,000	963,000
Western Gulf of Mexico west of Vermillion River	433,700	2,232	433,760	829,650
Mississippi River main stream	1,238,800	21,940	147,000	335,000
Mississippi River tributaries from east	333,600	12,360	2,472,590	4,940,300
Mississippi River tributaries from west, including Vermillion River	905,200	9,580	3,948,970	7,085,000
St Lawrence River to Canadian line	299,720	8,583	6,682,480	8,090,060
Colorado River, above Yuma, Arizona	225,000	521	2,918,500	5,546,000
Southern Pacific to Point Bonita, Cal	70,700	2,193	3,215,400	7,808,300
Northern Pacific	290,400	15,220	12,979,700	24,701,000
Great Basin	223,000		518,000	801,000
Hudson Bay	62,150	614	75,800	212,600
Total	4,508,289	94,612	36,906,200	66,449,310

TABLE 8.—POWER CONSUMPTION IN UNITED STATES FACTORIES, 1919

Power used for manufacturing	Total horse-power 1,000	Horse-power per wage earner	Horse power used per $1,000 of output
Agricultural Implements	128	2.4	0.42
Boots and Shoes	120	0.57	1.03
Cotton Goods	1,863	4.1	0.85
Flour and Grist Mill Products	876	19.4	0.427
Hosiery and Knit Goods	152	0.87	0.21
Iron and Steel	5,403	13.2	1.49
Lumber and Timber	2,922	6.08	2.11
Paper and Pulp	1,851	16.6	2.35
Silk Goods	177	1.39	0.25
Woolen Goods	172	2.77	0.47
Worsted Goods	296	2.4	0.401

Source U S Bureau of the Census

TABLE 9.—FOREST AREAS

Country	Forest area, million acres	Ratio of forest to total land area, %	Forest area per 100 inhabitants, acre
Asia	2,096	21.6	240
South America	2,093	44.0	3,215
North America	1,114	26.8	998
Africa	797	10.7	560
Europe	774	31.1	170
Australia and Oceania	283	15.1	3,470
United States	550,000	28.9	520
United Kingdom	3,515	4.3	10
Russia (European)	440,000	38.7	440
France	24,120	18.4	60
Germany	30,905	23.8	50
Czecho Slovakia	12,354	34.3	90
Rumania	21,758	27.8	120
Poland	21,881	22.8	90
Siberia	1,083,500	30.5	7,530
Switzerland	2,320	22.7	60
Italy	14,252	18.1	40
Spain	16,886	13.9	80
Netherlands	614	8.0	10
Denmark	872	8.2	30
Norway	17,037	21.4	650
Sweden	55,550	54.8	960
Japan	90,184	53.3	120
British East Indies	40,504	82.8	4,550
China	190,000	6.9	60
Canada	596,746	25.0	8,230
Brazil	1,000,000	47.5	3,280
Uruguay	1,070	2.3	70
French Guiana	21,000	98.0	42,000
Union of South Africa	1,511	0.5	25
Egypt and the Sudan	7,000	0.8	40
New Hampshire	3,602	62.3	813
California	33,000	33.1	962

Source Forest Resources of the World, Zon and Sparhawk

TABLE 10.—COAL OUTPUT PER MINER (IN TONS)

Pick out the countries whose miners use modern machinery

	Annual output per man employed underground			Daily output per man employed underground		
	1901	1910	1918	1901	1910	1918
United States	729	832	1,134	3.37	3.78	4.40
New South Wales	689	684	814		3.70	4.07
Nova Scotia	719	708	718	2.74	2.46	2.50
Prussia	357	367	409	1.22	1.26	
Great Britain	400	368	337	1.50	1.35	1.19
France	304	296		1.05	1.04	.91
Belgium	248	255	207	.84	.81	.72
Japan	176	168	* 155	.73	.73	* .72

Source United States Bureau of Mines. * For 1917

TABLE 11 —PETROLEUM PRODUCTION, MILLION BARRELS (1)

Note the great changes in a short period

	1900	1913	1922 (*a*)	Per cent of world production 1922
United States	63.6	248.1	557.5	64.9
Russia	75.8	62.8	35.0	4.1
Galicia	2.3	7.8	5.1	.6
Rumania	1.6	13.6	9.8	1.2
British India	1.1	7.9	7.9	.9
Dutch East India	2.3	11.2	16.0	1.9
Japan	0.9	1.9	2.0	.2
Mexico		25.7	185.0	21.5
Germany	0.4	1.0 (*a*)	0.2 (*a*)	02
World Production		381.5	857.9	

(1) Mineral Resources of United States, 1918, Part II, "Petroleum in 1918," pp 1143–1145
(*a*) Commerce Year Book, 1922, p 98

TABLE 12 —MACHINERY EXPORTS OF THE LEADING COUNTRIES

Machines make goods and they also make other machines Note the changes in this trade

	1910, millions (*a*)	1920, millions (*a*)	1923, millions (*b*)
Great Britain	$ 142.0	$ 232.1	$203.4
Germany	119.0	112.5	125.2
United States	110.0	536.3	260.6
France	20.0	37.0	49.9
Belgium	12.0	17.1	16.1
Switzerland	14.0	17.5	27.3
Netherlands	6.0	10.6	9.5
Sweden		31.7	29.3
Canada		14.6	15.9
All other	43.0	40.6	37.8
Total	$ 468.0	$1,080.0	$775.0

(*a*) From Chart in The Philadelphia Commercial Museum
(*b*) From Commercial America, July, 1924, page 15

TABLE 13 —STATISTICS OF AMERICAN SILK TRADE, 1914–1922

	Imports into the United States (a)						Exports from United States	
	Raw Silk				Manufactured Silk		Manufactured Silk	
	Amount in lbs 1914	Amount in lbs 1922	Value 1914	Value 1922	Value 1914	Value 1922	Value (c) 1914	Value (b) 1922
Japan	20,772,231	40,028,794	$ 71,755,416	$291,291 825	$ 4,246,724	$15,170,156	$ 7,016	$ 66,971
China	7,460,624	8,378,079	16,724,618	56,609,881	314,003	1,604,981	4 870	1,567
Italy	2,936,383	568 879	9,566,907	4 591,259	1,089,927	550,403	14 863	125,242
France	478,262	158,614	589,663	1 201,366	18,700 633	12,950 761	70,424	121,314
Switzerland	223,184	35,107	95,809	268,247	4,762,373	1,772,205	3 547	400
United Kingdom	1,716 670	199	431,907	1,021	4 346,649	1,672 234	348,088	176,400
Germany	66,592		18,150		5,010 727	2,948,895	74 865	9,629
Canada	767,526	898,321	1 686,983	7,516,761	38 548	30,638	1,228,196	99,599
Other Countries		643,833		4,307,046		724,000	555,736	432,878
Total	34,421,472	50,711,826	$100,869,453	$365,787,406	$38,509,584	$37,377,000	$2,307,605	$1,034,243

(a) Foreign Commerce and Navigation of the United States, 1922, p 65
(b) Foreign Commerce and Navigation of the United States, 1922, p 509
(c) Foreign Commerce and Navigation of the United States, 1914, p 647

TABLE 14 —MILLIONS OF COTTON SPINNING SPINDLES IN THE WORLD

Do these tables 14 and 15 show anything about the relative fineness of cotton manufacture in the United States and Switzerland? Explain the relative amounts of export in the United States and Switzerland

Millions of cotton spindles	1900	1912	1920 (1)	1923 (2)
Great Britain	45 5	55 3	56 4	56 6
Continent Europe	32 0	43 0	43 5	44 7
Germany	8 0	10 7	9 4	9 6
Total Europe	77 5	98 3	99 9	101 3
United States (a)				
Cotton states	4 3	11 5	15 1	16 5
Other states	15 0	19 0	20 7	20 9
Total U S	19 4	30 5	35 8	37 4
British India	4 9	6 1	6 8	7 3
Japan	1 2	2 1	3 8	4 9
China	0 5	0 8	1 6	2 6
Canada	0 5	0 8	1 1	1 4
Mexico	0 4	0 6	0 7	0 7
Total world	105 6	141 0	151 4 (b)	157 8

(1) Statesman's Year Book, 1921, p XXIV, figures of Jan 30, 1921
(2) *Commerce Year Book, 1923, p 299 for year ending July 31*
(a) Statistical Abstract, 1920, pp 262–263, State figure of Aug 31, 1920, County, July 31
(b) Adjusted to United States figures taken from United States Statistical Abstract

TABLE 15 —COTTON MANUFACTURED, 1922–1923

	Pounds of cotton consumed per capita (a)	Exports, million dollars (K)
United States	27 7	145 4 (b)
United Kingdom	29 0	833 9 (c)
France	13 2	119 0 (g)
Germany	8 4	0 8 (L)
Switzerland	13 6	58 5 (f)
Spain	8 1	9 2 (H)
Japan	19 7	160 9 (d)
Italy	11 2	81 2 (e)

(a) U S Dept Commerce Reports, Jan 14, 1924, p 95 year ending July 31, 1923
(b) Statesman's Year Book, p 472
(c) Statesman's Year Book, 1924, p 62 (d) *Ibid*, p 1064 (e) *Ibid*, p 1037
(f) *Ibid*, p 1331 (g) *Ibid*, p 877 (H) *Ibid*, p 1297
(K) Converted into dollars considering exchange at yearly average for 1922
(L) Includes Reports to United Kingdom only, figure for 1922 Statesman's Year Book, 1924, p 949

TABLE 16.—WORLD'S MERCHANT MARINE (Figures from the Shipping World for 1915) and Lloyd's Register for 1922–1923

Gross Tonnage of the Vessels of 100 tons and upwards

One of the explanations of the fact that the British are a wealthy people. How many war results can you see in this table? In 1923 and 1924 many of these ships were idle.

Country	Tonnage in thousands, 1915	Tonnage in thousands, 1922
British	19,988.0 (46% of total)	22,012.5 (34% of total)
German	5,072.0	1,887.4
American (d)	2,380.0	17,062.5 (26% of total)
French	1,861.0	3,845.8
Norwegian	1,914.0	2,600.9
Japanese (a)	1,680.0	3,586.9
Italian	1,442.8	2,866.3
Dutch	1,508.0	2,632.7
Russian (e)	970.0	
Swedish	1,016.3	1,115.4
Austrian	1,016.6	
Spanish	876.0	1,282.8
Danish	715.0	1,038.1
Greek (e)	830.0	668.1
Belgian	347.0	579.5
Brazilian	275.6	492.6
Argentinian	163.7	181.6
Chilian	86.4	131.4
Turkish (e)	116.0	
Chinese	87.0	188.4
Portuguese	80.0	285.9
Cuban		62.7
Esthonian		45.3
Finnish		213.7
Latvian		40.1
Rumanian		72.3
Peruvian		101.2
Uruguayan		76.3
Other Countries		691.6
Flag not recorded		309.1
Total for all Countries	42,742.7	64,370.8

Source: Statistical Abstract of the United States, 1922, p. 735, is taken from Lloyd's Register, 1922–23.

(a) Japanese sailing vessels not included.

(d) Vessels trading in the Caspian Sea, and wood vessels trading on the Great Lakes of North America are not included.

(e) In the absence of satisfactory information the records of most of the sailing vessels belonging to Greece, Turkey, and Southern Russia, are omitted.

TABLE 17 —RECEIPTS OF GRAIN AT VARIOUS AMERICAN MARKETS IN PRODUCING REGIONS

	Year	Million bushels		
		Wheat (a)	Oats (b)	Corn (c)
Indianapolis	1913–14	1 8	5 3	14 1
	1918–19	6 4	14 8	25 9
	1922–23	5 1	10 5	18 3
Chicago	1913–14	50 8	105 7	84 8
	1918–19	54 5	115 7	61 3
	1922–23	51 6	84 4	115 9
Milwaukee	1913–14	6 3	18 4	15 8
	1918–19	15 5	34 7	6 7
	1922–23	3 6	21 0	15 2
Minneapolis	1913–14	103 6	22 9	10 7
	1918–19	117 7	37 0	6 6
	1922–23	133 8	24 8	7 5
Duluth	1913–14	62 7	5 7	8
	1918–19	88 3	2 6	006
	1922–23	65 5	1 3	6
St Louis	1913–14	27 2	25 9	16 9
	1918–19	42 5	30 8	19 2
	1922–23	40 6	32 2	29 8
Toledo	1913–14	5 8	3 6	4 5
	1918–19	5 9	9 0	1 1
	1922–23	10 4	3 7	3 1
Detroit	1913–14	1 4	3 8	2 8
	1918–19	1 6	8 1	1 6
	1922–23	1 8	3 4	1 9
Kansas City	1913–14	32 1	11 3	27 5
	1918–19	54 1	16 6	16 1
	1922–23	77 6	10 5	15 5
Peoria	1913–14	1 6	12 1	14 7
	1918–19	3.4	8 5	18 5
	1922–23	4 3	15 5	21 1
Omaha	1913–14	16 4	15 9	37 1
	1918–19	19 7	20 6	21 8
	1922–23	25 3	14 7	22 7
San Francisco	1913–14	7 0	1 6	0 4
	1918–19	7 9	0 9	0 4
	1922–23	14 6	1 0	1 0
Seattle	1913–14	8 9	(2)	(2)
	1918–19	7 3	(3) 1 3	(3) 0 5
	1922–23	10 4	(3) 0 6	(3) 1 9
Tacoma	1913–14	12 1	(2)	(2)
	1918–19	7 4	(3) 0 3	(3) 0 2
	1922–23	9 8	(3) 0 3	(3) 0 6
Winnipeg (1)	1913–14	158 0	51 6	
	1918–19	133 6	24 3	
	1922–23	301 1	41 0	

(a) Wheat year, July 1–July 1, Year Book, Dept Agric , 1923, p 615
(b) Oat year, Aug 1–Aug 1, Year Book, Dept Agric , 1923, p 689
(c) Corn year, Nov 1–Nov 1, Year Book, Dept Agric , 1923, p 671

Compiled from Miller's Almanac, except that San Francisco for 1913–14 and 1918–19 was compiled from the San Francisco Chamber of Commerce, Annual Statistical Report

(1) Winnipeg receipts are inspections for western Canada, most of the inspecting of western Canadian grain is done at Winnipeg

(2) Material not available (3) Calendar years

TABLE 18(A).—IMPORTS OF VEGETABLE OIL MATERIALS BY SELECTED COUNTRIES

(In tons)

Oil Materials	United States		Great Britain		France		Germany	
	1913	1922	1913	1922	1913	1922	1913	1922
Copra	15,175	126 348	34,572	96 414	124 163	125,098	216 710	311 595
Palm kernels				237,594	3 292	23,427	250 056	139 862
Cottonseed			689,172	541,658	19 477	87	242 282	21 399
Peanuts				73 647	543,918	504,078	108,119	126 382
Soya beans			85,626	66 480	49	11		95 246
Linseed (flaxseed)	184,244	417 568	733 389	401 950	261,693	148,601	617 760	113,709
Rape seed			59 485	37 419	903	69	169 122	135,979
Castor beans	19,416	40,836	67,510	20,652				
Colza and black poppy seed					10 281	8 892		
Sesame seed					22 692	12 444	127,909	17,281
Mustard seed and white and red poppy seed		7,288			58 225	21 870		
All other seeds, nuts and kernels			84,607	57,674	84,234	45,682	180 968	14,812
Total			1 754 361	1,531,488	1 038 957	890,259	1 912,926	976 265

Adapted from "World Trade in Vegetable Oils and Animal Fats," by J E Wrenn, U S Bureau of Foreign and Domestic Commerce

TABLE 18(B) —IMPORTS OF VEGETABLE OILS BY SELECTED COUNTRIES

(In tons)

Oils	United States		Great Britain		France		Germany	
	1913	1922	1913	1922	1913	1922	1913	1922
Coconut, palm kernel, illipe, etc	49,969	113,660	65,494	42,997	3,910	4,827	708	36,200
Cottonseed	5,703		19,774	5,374	9,767	2,345	17,946	2,937
Olive	26,761	44,062	10,130	8,729	15,963	29,150	2,519	385
Palm	27,036	28 758	87,483	79,818	17,395	23,148	16,614	5 627
Peanut.	5,635	1,235			20	820		2,979
Soya bean	7,111	8,647		22,800	208	1,959	3,461	45,718
Linseed	606	72,068	13,314	4,552	2,336	4,531	3,488	32 229
Rape seed	5,414	724	8,511	1 401	8	13	1,295	1,540
Castor and pulghere	20	415	1,567	2,817	230	592	10,501	3,868
Chinese nut	21 293	39,545						
Colza and black poppy seed					248	283		
Sesame seed					42		762	212
Mowrah, shea, etc							3,819	1,372
All other vegetable oils	2,763	5,288	26,087	9,523	129	155	8,489	5,495
Total	152,311	314,402	232,360	178,011	50,256	67,823	69,602	138,562

Adapted from "World Trade in Vegetable Oils and Animal Fats," by J E Wrenn, U S Bureau of Foreign and Domestic Commerce

	(1)	(2)	(3)	Wheat (4)		Corn (5)		Oats (6)		Barley (7)	
	Area 1,000 Sq. Mi.	Population 1,000	Population Per Square Mile	Crop Million Bushels	Yield Per Acre, Bushels	Crop Million Bushels	Yield Per Acre, Bushels	Crop Million Bushels	Yield Per Acre, Bushels	Crop Million Bushels	Yield Per Acre, Bushels
Maine	30.0	768	25.7	0.16	26.0	0.68	38.0	1.62	37.0	0.09	30.0
New Hampshire	9.0	443	49.1			1.09	42.0	0.67	37.5	0.03	26.5
Vermont	9.1	352	38.6	0.08	21.0	3.28	39.0	3.08	35.0	0.26	29.0
Massachusetts	8.0	3,852	479.2			2.54	43.0	0.31	35.0		
Rhode Island	1.0	604	566.4			0.16	38.0	0.03	32.0		
Connecticut	4.8	1,381	286.1			3.12	41.0	0.29	29.0		
New York	47.6	10,385	217.9	8.16	20.2	24.56	32.4	32.75	32.2	5.09	26.8
New Jersey	7.5	3,156	420.0	1.18	20.0	9.44	40.0	1.63	24.0		
Pennsylvania	44.8	8,720	194.5	24.34	19.0	61.61	40.0	33.93	29.0	0.27	22.4
Delaware	1.9	2,231	113.5	1.91	18.0	6.06	33.1	0.18	26.0		
Maryland	9.9	1,450	145.6	10.42	19.2	25.23	39.3	1.76	29.8	0.13	33.0
Virginia	40.3	2,309	57.4	11.14	13.3	53.56	29.0	3.58	22.0	0.27	27.0
West Virginia	24.0	1,464	60.9	2.96	13.0	20.13	31.0	4.70	24.0		
North Carolina	48.7	2,559	52.5	6.04	11.1	58.57	22.5	5.08	22.0		
South Carolina	30.5	1,684	55.2	1.92	11.0	32.67	16.5	10.73	21.0		
Georgia	58.7	2,896	49.3	1.74	9.2	49.21	12.2	9.38	18.0		
Florida	54.9	968	17.7			10.25	12.5	0.40	12.0		
Ohio	40.7	5,759	141.4	42.78	18.2	159.86	41.0	52.30	34.5	2.00	27.0
Indiana	36.0	2,930	81.3	34.25	16.5	192.62	38.5	48.69	28.0	0.70	23.0
Illinois	56.0	6,485	115.7	62.51	18.0	337.31	37.5	135.10	35.0	6.61	29.0
Michigan	57.5	3,668	63.8	16.58	17.0	58.17	34.5	48.90	32.0	3.60	24.0
Wisconsin	55.3	2,632	47.6	1.97	16.6	83.36	37.0	92.17	36.3	13.25	28.5
Minnesota	80.9	2,387	29.5	20.78	12.0	154.69	36.0	153.25	37.0	24.05	25.0
Iowa	55.6	2,404	43.2	14.35	18.2	430.24	40.7	203.00	36.0	4.57	28.4
Missouri	68.7	3,404	49.5	37.95	13.0	196.86	30.0	31.50	25.0	0.16	27.0
Kansas	81.8	1,769	21.6	83.86	10.1	122.15	21.7	34.92	26.1	21.47	22.2
Nebraska	76.8	1,296	16.9	31.39	9.9	272.05	33.0	81.05	33.0	0.49	28.0
North Dakota	70.2	647	9.2	58.60	7.1	28.20	33.5	54.92	23.0	23.82	17.5
South Dakota	76.9	637	8.3	26.91	9.6	145.18	31.5	78.34	34.0	20.02	22.5
Kentucky	40.2	2,417	60.1	7.69	12.4	87.87	28.5	4.72	21.0	0.19	27.0
Tennessee	41.7	2,338	56.1	4.51	10.2	73.94	24.5	4.30	21.0	0.39	23.0
Alabama	51.3	2,348	45.8	0.20	10.0	48.99	14.8	4.79	17.3		
Mississippi	46.4	1,791	38.6	0.06	15.0	33.74	14.5	2.28	19.0		
Louisiana	45.4	1,799	39.6			24.70	15.4	1.23	22.0		
Texas	262.4	4,663	17.8	16.37	10.5	96.44	18.5	47.04	22.0	2.59	24.0
Oklahoma	69.4	2,028	29.2	36.30	11.0	37.54	11.5	24.00	20.0	2.84	22.0
Arkansas	52.5	1,752	33.4	0.77	11.0	39.04	19.5	6.19	23.0		
Montana	146.1	549	3.8	52.49	14.9	9.49	26.0	22.21	33.0	2.47	25.5
Wyoming	97.5	194	2.0	2.78	15.9	4.05	27.0	5.95	34.0	0.87	31.0
Colorado	103.7	940	9.1	18.00	12.9	37.25	25.0	6.34	32.0	6.41	29.0
New Mexico	122.5	350	2.9	1.30	12.0	3.62	16.4	1.16	20.0	0.21	19.0
Arizona	113.8	334	2.9	1.09	26.0	0.99	30.0	0.57	30.0	1.26	35.0
Utah	82.2	449	5.5	6.57	24.1	0.77	24.9	3.06	37.8	0.89	40.6
Nevada	109.8	77	0.7	0.51	25.4	0.02	23.3	0.11	35.4	0.15	25.4
Idaho	84.4	432	5.2	30.11	28.6	3.07	42.0	7.82	46.0	4.00	43.0
Washington	66.8	1,356	20.3	61.74	25.0	2.74	37.0	11.97	57.0	3.88	45.7
Oregon	95.6	783	8.2	26.81	24.1	2.48	35.0	10.53	39.0	3.08	35.0
California	155.7	3,427	22.0	16.16	21.6	4.48	35.0	5.26	32.5	33.07	30.2
Total	2,973.8	105,710	35.5	785.7	13.5	3,054.4	29.3	1,299.8	31.8	198.2	25.1

(1) Statistical Abstract, 1922, p. 1.
(2) *Ibid.*, p. 34.
(3) *Ibid.*, p. 40.
(4) Yearbook Dept. Agriculture, 1923, pp. 603, 605.
(5) Yearbook Dept. Agriculture, 1923, pp. 664, 665.
(6) Yearbook Dept. Agriculture, 1923, pp. 681, 682.
(7) Yearbook Dept. Agriculture, 1923, pp. 697, 698.
(8) Yearbook Dept. Agriculture, 1923, pp. 637, 638.

PRODUCTION, UNITED STATES, 1923

the United States Department of Agriculture)

Rye (8)		Potatoes (9)		Cotton (10)		(11)	(12)	(13)	(14)	(15)	(16)
Crop Million Bushels	Yield Per Acre, Bushels	Crop, Million Bushels	Yield Per Acre, Bushels	Crop, Million Bushels	Yield Per Acre, Bushels	Dairy cattle 1,000	Other cattle 1 000	Horses 1,000	Mules 1,000	Sheep 1 000	Swine 1,000
		31 99	258			211	57	88		90	76
		2 40	185			126	36	35		18	31
		4 32	180			385	83	74		44	62
0 05	18 0	4 55	175			189	39	46		14	75
		0 33	165			27	7	6		3	11
0 09	18 0	3 56	155			141	38	36		8	44
0 94	16 3	39 73	123			1,628	393	505	7	513	557
1 157	17 8	7 60	95			151	31	70	6	10	133
3 65	17 0	26 14	105			1,071	486	486	55	482	1,212
0 08	14 4	0 80	80			41	10	25	9	3	44
0 27	15 8	3 92	80			196	103	135	33	96	299
0 50	12 0	14 14	93	50	325	426	460	288	97	355	655
0 10	10 0	5 88	120			220	365	159	15	501	316
0 60	10 4	3 96	86	1,020	290	365	266	163	260	82	1,159
0 07	10 5	3 14	98	795	187	228	189	70	213	23	569
0 18	9 0	1 54	70	590	82	519	693	89	371	63	1,542
		1 75	92	12	40	97	774	37	43	64	633
1 30	15 5	12 35	98			1,090	810	763	32	2,115	3,077
4 19	14 0	7 87	105			757	779	682	101	700	3,880
3 45	15 0	9 57	92			1,159	1,545	1,171	170	593	5,368
6 54	14 0	35 80	114			987	611	582	6	1,171	1,165
5 06	14 8	26 11	96			2,217	858	630	4	341	1,673
12 31	13 5	38 30	96			1,674	1,276	869	10	428	3,800
0 92	17 1	6 80	84			1,206	3,479	1,241	93	928	10,539
0 32	12 5	9 30	100	15	162	793	2,061	861	369	1,205	4,463
0 35	8 5	5 16	86			723	2,537	958	286	299	2,980
1 58	12 0	8 88	80			587	2,727	883	114	660	5,223
10 05	7 8	13 11	83			533	806	781	8	254	651
3 50	11 5	7 74	88			455	1,551	745	11	696	3,029
0 23	11 7	4 93	85			525	166	363	278	701	1,109
0 20	10 0	2 88	90	220	90	480	579	300	336	326	1,373
0 01	12 0	3 52	80	600	91	516	469	128	314	86	1,089
		1 11	74	615	89	536	636	211	308	135	1,063
		1 64	63	365	125	220	573	168	180	116	665
0 20	12 0	1 92	55	4,290	146	1,063	5,597	980	851	3,091	1,904
0 44	12 0	2 77	66	620	90	549	1,160	653	337	80	1,121
0 01	9 0	1 95	59	620	97	506	419	218	328	81	952
2 11	11 0	3 96	110			194	1,222	643	9	2,370	270
0 31	13 0	1 71	95			48	793	198	3	2,767	119
0 88	12 0	13 53	123			261	1,279	400	33	2,360	622
0 02	12 0	0 15	50			47	1,160	176	21	2,248	71
		0 24	60	83	311	46	1,092	130	12	1,155	57
0 12	11 4	2 69	168			92	446	128	3	2,457	121
		0 87	174			24	345	49	2	1,141	28
0 27	19 0	11 72	175			172	537	265	8	2,491	378
0 36	15 7	8 06	155			289	253	222	21	598	239
0 55	15 0	4 18	95			238	577	230	13	1,916	220
		7 80	150	49	277	664	1,421	323	60	2,150	834
63 0	12 2	412 4	108 1	10,084	128 8	24,675	42,126	18,263	5,436	38,361	65,501

(9) Yearbook Dept Agriculture, 1923, pp 760, 761
(10) Yearbook Dept Agriculture, 1923, pp 798, 799
(11) Yearbook Dept Agriculture, 1923, p 880
(12) Yearbook Dept Agriculture, 1923, p 880
(13) Yearbook Dept Agriculture, 1923, p 1025
(14) Yearbook Dept Agriculture, 1923, p 1025
(15) Yearbook Dept. Agriculture, 1923, p 982
(16) Yearbook Dept. Agriculture, 1923, pp 945, 946

TABLE 20.—AGRICULTURAL PRODUCTION, 1923

	Wheat, million bushels (1)	Corn, million bushels (2)	Barley, million bushels (3)	Oats, million bushels (4)	Rye, million bushels (5)	Potatoes, million bushels (6)
United States	785.7	3,054.1	198.1	1,299.8	63.0	412.3
New Brunswick	.1		.2	9.9	.1	12.3
	(x, a)		(x, a)	(x, a)	(x, a)	(x, a)
Ontario	19.9		14.0	116.0	2.5	20.4
	(x, a)		(x, a)	(x, a)	(x, a)	(x, a)
Quebec	2.3		3.5	62.3	.3	28.3
	(x, a)		(x, a)	(x, a)	(x, a)	(x, a)
Manitoba	36.5		28.9	74.4	7.1	6.2
	(x, a)		(x, a)	(x, a)	(x, a)	(x, a)
Saskatchewan	252.6		18.5	179.7	16.2	7.7
			(x, a)	(x, a)	(x, a)	(x, a)
Alberta	157.5		6.2	35.7	6.2	4.7
			(x, a)	(x, a)	(x, a)	(x, a)
Total Canada	469.8	16.4	80.3	531.4	26.9	113.9
Mexico	13.6	68.2	3.9			
	(x)	(x)	(x)			
Total North America	1,255.8	3,078.6	278.5	1,831.2	89.9	526.3
Argentina	248.7	153.1	9.2	58.6	3.7	
				(x)		
Chile	23.8	1.8	5.4	3.0	.1	10.9
	(x)		(x)	(x)	(x)	
Uruguay	3.7	8.6		1.0		.2
	(x)			(x)		(x)
Esthonia	.7			9.8	6.8	23.6
	(x)					
Hungary	67.7	55.1	24.6	25.5	32.1	63.0
Belgium	12.6		4.2	36.3	19.5	88.8
Bulgaria	38.8	22.0	12.3	10.0	8.5	1.2
Czechoslovakia	36.5	10.4	55.2	86.3	51.8	231.0
Denmark	9.2		30.4	58.4	14.2	49.2
	(x)		(x)	(x)	(x)	(x)
Finland	.5		3.8	21.3	9.4	15.8
France	290.5	11.8	47.0	377.5	36.9	350.3
Germany	103.6		99.1	411.7	282.4	1,197.1
Greece	13.5		7.1	6.0		
Italy	224.8	83.9	10.5	39.8	6.4	62.5
Yugoslavia	61.9	89.1	14.3	19.3	5.9	31.1
		(x)				
Lithuania	3.1			23.3	24.9	55.2
Austria	8.8			26.0	15.6	51.4
Netherlands	6.7		2.9	23.9	15.4	81.9
Norway	.5		3.8	10.0	.8	28.6
Poland	53.3	2.7	81.9	259.9	257.5	903.4
		(x)				
Rumania	102.5	174.1	68.9	63.7	10.2	37.7
						(x)
Spain	157.1	23.9	111.9	40.4	28.0	95.5

TABLE 20.—AGRICULTURAL PRODUCTION, 1923
(*Continued*)

	Wheat, million bushels (1)	Corn, million bushels (2)	Barley, million bushels (3)	Oats, million bushels (4)	Rye, million bushels (5)	Potatoes, million bushels (6)
Sweden	11.6		11.7	66.6	25.3	61.2
Switzerland	3.6	.2	.5	3.0	1.6	23.3
United Kingdom	57.1		55.5 (x)	199.0	.2 (x)	321.8 (x)
Latvia	1.3		6.9	20.5	10.9	24.8
Total Europe	1,269.7	385.3	635.2	1,772.5	856.3	4,495.3 (x)
India	369.3	96.2 (x)	146.0 (x)			
Cyprus	2.6 (x)		2.0 (x)	.3 (x)		
Russia in Asia	45.4 (x)		4.5 (x)	36.1 (x)	16.6 (x)	21.9 (x)
Japanese Empire	35.7		112.1	5.1 (x)		57.9 (v)
Total Asia	404.9	99.2 (x)	272.4 (x)			
Algeria	35.6	.1	46.5	15.9		.8
Egypt	40.6	73.5 (x)	12.0			
Morocco	23.5	4.6 (x)	32.7	1.1		
Tunis	9.9	.3	11.5	2.7		.1
Union of South Africa	6.7 (z)	50.4	1.3 (y)	5.2 (y)	.7 (y)	4.3 (v)
Total Africa	116.4	113.5 (v)	104.3 (v)			
Australia	120.0	7.8 (x)	6.3 (y)	15.2 (v)	.1 (v)	
New Zealand	8.4 (a)	.5	1.2 (y)	7.1 (x)		4.2 (x)
Total World	3,409.0	3,750.9	1,137.7	3,632.1	952.7	5,043.9 (v)

(1) U. S. Dept. of Agriculture Year Book, p. 609
(2) *Ibid.*, p. 668
(3) *Ibid.*, p. 701
(4) *Ibid.*, p. 685
(5) *Ibid.*, p. 641
(6) *Ibid.*, p. 764
(x) 1922
(a) Statesman's Year Book, 1924, pp. 279–280
(y) 1921–1922
(z) 1922–1923.
(v) 1921

TABLE 21 —COMMERCIAL AND FINANCIAL STATISTICS OF PRINCIPAL COUNTRIES OF THE WORLD

	Area, sq mi	Population, millions	Population per sq mi	Railroad mileage	Total imports, million dollars	Imports per cap, dollars	Percentage of imports from U S	Total exports, million dollars	Exports per cap, dollars	Percentage of exports to U S	Railroad mileage per 1,000 sq mi	Railroad mileage per 10,000 pop
North America and West Indies												
Canada	3 729,665	8 9	2 40	39,771	795 4	88 71	67 4	924 7	103 13	39 8	10 7	44 4
Central American States												
Costa Rica, 1922	18,691	5	25 95	410	8 3	17 21	61 1	14 2	29 33	55 8	21 9	8 5
Guatemala	43,641	2 0	45 94	478	13 6	6 79	59 9	12 1	6 04	66 8	11 0	2 4
Honduras, 1921	46 250	6	14 31	556	16 7	25 26	83 9	5 4	8 20	91 1	12 0	8 4
Nicaragua, 1921	49,552	6	12 88	169	5 3	8 32	72 6	7 1	11 10	74 5	3 4	2 6
Panama, 1921	32,380	4	13 40	301	11 4	26 20	72 7	2 5	5 75	98 2	9 3	6 9
Salvador, 1920	13,176	1 5	115 82	260	12 6	8 28	61 6	14 9	9 82	57 8	19 7	1 7
Cuba 1921	44,218	2 9	65 56	3,020	356 4	122 95	74 5	278 1	95 94	80 0	68 3	10 4
Haiti, 1922	11 072	1 6	147 31	112	12 3	7 57	83 9	10 7	6 57	13 4	10 1	7
Mexico, 1920	767,260	14 5	18 85	16,442	178 2	12 32	74 6	202 7	14 01	88 3	21 4	11 4
Santo Domingo (Dom Rep), 1922	19 325	9	46 42	408	14 3	15 96	77 4	14 9	16 58	44 0	21 1	4 5
United States, 1922	3,627 557	110 9	30 58	262 544	3 112 7	28 06		3,765 1	33 94		72 4	23 7
Porto Rico, 1922	3,435	10 9	392 14	339	64 8	48 12	89 4	65 1	48 34	92 3	98 7	2 5
South America												
Argentina, 1920	1 136 137	8 7	7 66	21 935	846 0	97 25	33 2	946 9	108 86	16 5	19 3	25 2
Bolivia, 1920	613 900	2 9	4 71	1 401	20 4	7 05	30 2	43 5	15 07	45 7	2 3	4 8
Brazil, 1921	3 145 550	30 6	9 74	17,907	226 5	7 39	31 2	222 3	7 26	36 7	5 7	5 8
Chile, 1921	289,796	3 8	13 18	5,102	106 2	27 80	28 6	123 9	32 45	17 6	17 6	13 4
Colombia, 1919	435 278	6 3	14 47	926	41 7	6 62	57 2	75 8	12 03	73 4	2 1	1 5
Dutch Possessions, 1919	50 282	1	3 30	117	10 7	64 34	32 4	5 5	33 16	73 1	2 3	7 0
Ecuador, 1921	118 627	2 0	16 86	413	6 9	3 48	34 2	10 0	5 03	45 1	3 5	2 1
Paraguay, 1921	97,722	1 0	10 23	308	6 1	6 10	17 3	6 8	6 80	11 8	3 2	3 1
Peru, 1921	533,912	7 3	13 67	1 997	62 7	8 59	49 5	62 1	8 51	38 7	3 7	2 7
Uruguay, 1922	72 172	1 5	21 19	1,660	64 9	42 47	21 3	61 7	40 36	2[illegible] 8	23 0	10 9
Venezuela, 1921	393 977	2 4	6 12	646	14 1	5 85	64 5	22 0	9 14	40 3	1 [illegible]	2 7

TABLE 21 —COMMERCIAL AND FINANCIAL STATISTICS OF PRINCIPAL COUNTRIES OF THE WORLD (*Continued*)

	Area, sq mi	Population, millions	Population per sq mi	Railroad mileage	Total imports, million dollars	Imports per cap., dollars	Percentage of imports from U S	Total exports, million dollars	Exports per cap., dollars	Percentage of exports to U S	Railroad mileage per 1,000 sq mi	Railroad mileage per 10,000 pop
Europe												
Austria, 1922	32 395	6.4	198.27	4 125	322.3	50.18	00.5	212.0	33.01	01.4	127.3	6.4
Belgium	11 753	7.4	635.24	5 686							483.8	7.6
Bulgaria, 1921	39 825	4.8	122.06	1 829	25.9	5.33	07.4	19.7	4.05	02.0	45.9	3.8
Czechoslovakia 1921	54,190	13.6	251.17	8 718	282.4	20.75	20.3	343.8	25.26	02.8	160.9	6.4
Denmark 1921	17 149	3.3	191.85	3 092	302.1	91.86	20.2	251.0	76.32	02.7	180.3	9.4
Finland, 1921	149 639	3.4	22.74	2 660	73.9	21.72	17.7	60.2	17.68	08.2	17.8	7.8
France, 1922	212 736	39.2	194.31	33 568	1,938.0	49.43	16.1	1 673.2	42.67	09.6	157.8	8.6
Germany, 1922	182,264	59.8	328.40	35 209	1 475.7	24.65	21.5	914.9	15.79	11.7	193.2	5.9
Greece, 1922	49 167	5.9	121.02	1 983	85.1	14.31	21.7	65.6	11.02	26.6	40.3	3.3
Hungary, 1921	35 832	7.9	221.90	4 493	91.1	11.46	01.3	47.2	5.94	00.1	125.4	5.7
Italy 1922	119 991	38.8	323.69	12 885	751.0	19.34	27.0	443.5	11.42	10.0	107.4	3.3
Netherlands 1922	13 205	6.9	528.36	2 380	780.5	111.86	13.4	470.6	67.45	05.1	180.2	3.4
Norway, 1921	125 017	2.6	21.05	2 141	218.2	82.91	19.0	90.2	34.29	13.0	17.1	8.1
Poland, 1922	149 220	27.2	194.20	9 541	161.1	5.92	05.9	124.9	4.52	01.6	63.0	3.5
Portugal, 1919	35,501	6.0	170.16	2 128	126.2	20.89	20.1	58.8	9.74	04.6	59.9	3.5
Rumania, 1920	113 608	16.3	143.14	7 325	137.8	8.47	08.1	68.0	4.19	00.03	64.5	4.5
Russia 1922	8 607,766	131.3	16.27	42 504	134.9	1.03	21.4	38.5	.29	01.4	5.2	3.2
Spain, 1920	195,041	21.3	109.40	9 842	226.6	10.62	23.4	161.0	7.65	67.9	50.5	4.6
Sweden, 1921	173 151	5.9	34.39	9 439	285.2	47.64	19.3	247.2	41.28	08.9	54.5	15.8
Switzerland, 1922	15 945	3.9	243.71	3 586	358.1	92.17	10.1	321.6	82.77	11.0	224.9	9.2
United Kingdom, 1922	121,438	47.3	389.19	23 734	4 453.1	94.22	22.1	3 190.0	67.50	07.6	195.4	5.0
Yugoslavia, 1921	96,134	12.0	125.00	5 696	97.6	8.13	02.4	55.3	4.85	00.2	59.3	4.7
Asia												
China, 1922	4 278,352	431.5	100.85	6 818	799.2	1.85	17.3	536.8	1.24	14.9	1.6	.2
French Indo China, 1922	274 457	18.9	69.16	1 265	68.8	3.63	01.2	91.2	4.80	00.5	4.6	.7
India (British) 1922	1 802 577	318.0	176.94	37 265	705.5	2.20	08.1	613.7	1.42	10.9	20.[illegible]	1.2

TABLE 21 —COMMERCIAL AND FINANCIAL STATISTICS OF PRINCIPAL COUNTRIES OF THE WORLD (*Continued*)

	Area, sq mi	Population, millions	Population per sq mi	Railroad mileage	Total imports, million dollars	Imports per cap , dollars	Percentage of imports from U S	Total exports, million dollars	Exports per cap , dollars	Percentage of exports to U S	Railroad mileage per 1,000 sq mi	Railroad mileage per 10,000 pop
Asia (*Continued*)												
Japan, 1922	147,698	57 6	390 36	8,475	902 5	15 65	31 5	783 4	13 59	44 7	57 4	1 5
Formosa, 1921	13,750	3 6	265 82	396	64 6	17 68	03 7	73 5	20 12	02 2	28 8	1 1
Chosen, 1922	84,103	17 3	205 27	1,157	112 1	6 49	06 2	105 3	6 10	00 1	13 8	7
Dutch East Indies, 1921	732,254	47 2	64 46	2,011	363 0	7 69	10 1	400 0	8 47	05 9	2 7	4
Persia, 1922	628,164	9 5	15 12	350	53 8	5 67	00 9	44 4	4 68	05 9	6	4
Siam, 1922	194,568	9 3	47 91	1,376	53 9	5 79	05 6	65 6	7 04	00 1	7 0	1 5
Philippine Islands, 1922	115,026	10 9	94 82	803	83 0	7 61	60 4	94 5	8 66	62 6	7 0	7
Africa												
Algeria (French), 1921	222,119	5 8	26 14	2 722	133 6	23 01	08 5	101 9	17 55	00 5	12 3	4 7
Egypt, 1922	347,840	13 5	38 96	3 065	198 4	14 64	03 7	222 9	16 45	18 9	8 8	2 3
Sudan, 1921	1,014,600	5 8	5 77	1,500	22 9	3 92	01 0	8 1	1 39	05 2	1 5	2 6
Eritrea (Massana), 1921	45,946	4	9 79	138	4 7	10 49		1 2	2 67		3 0	3 1
Kongo (Belgian), 1919	913,127	15 0	16 43	1,263	10 6	70	20 2	23 8	1 59	00 7	1 4	8
Liberia, 1921	36,834	1 5	40 72		1 2	82	11 8	8	55*	00 3		
Libia (Italian), 1921	406,000	1 2	2 46	106	4 8	4 76		1 2	1 19		3	1
Morocco, 1919	221,163	6 0	27 13	840	78 0	13 00	04 1	33 6	5 61	02 2	3 8	1 4
Tunis, French, 1921	48,313	2 1	43 34	1 287	53 8	25 71	11 7	50 2	23 97	00 6	26 6	6 1
Union of South Africa, 1922	473,096	6 9	14 65	10,890	209 2	30 19	12 0	122 7	17 71	06 8	23 0	15 7
Australasia												
Australia, 1921	2,974 581	5 6	1 89	26 202	608 9	108 06	22 5	449 7	79 81	05 2	8 8	46 5
New Zealand, 1921	103,581	1 3	12 22	3,156	164 6	130 06	19 1	165 4	103 66	04 7	30 5	24 9

From Statistical Abstract of the U S for 1922, p 727
From Statistical Abstract of the United States 1922, p 732
From Statistical Abstract of the U S 1922, p 730
* From the Statesman's Year Book, 1924, p 1210

TABLE 22 —DISTRIBUTION OF UNITED STATES FOREIGN TRADE, 1922

(A) Exports by Continents

	Crude materials for use in manufacturing		Foodstuffs in crude condition and food animals		Foodstuffs partly or wholly manufactured		Foodstuffs for further use in manufacturing		Manufactures ready for consumption		Miscellaneous		Total Value	
	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of total exports
Europe	733	74.7	312	67.9	418	71.1	211	48.1	379	29.3	2	25.0	2055	54.6
North America	145	14.8	129	28.2	101	17.1	99	22.6	404	31.3	4	50.0	882	23.4
South America	3	.3	3	.6	19	3.3	34	7.8	165	12.8			224	5.9
Asia, Oceania	96	9.7	13	2.8	42	7.1	90	20.6	309	23.9			549	14.6
Africa	5	.5	2	.5	8	1.4	4	.9	35	2.7	2	25.0	56	1.5
Total	981	26.1	459	12.2	588	15.6	438	11.6	1292	34.3	8	.21	3765	100.0

(B) Imports by Continents

	Crude materials for use in manufacturing		Foodstuffs in crude condition and food animals		Foodstuffs partly or wholly manufactured		Foodstuffs for further use in manufacturing		Manufactures ready for consumption		Miscellaneous		Total Value	
	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of class	Million dollars	Per cent of total imports
Europe	215	18.5	31	9.5	72	18.6	261	47.3	400	60.3	12	66.6	991	31.8
North America	192	16.5	102	30.8	259	66.7	127	23.0	140	21.2	2	11.1	822	26.4
South America	127	10.9	155	47.0	6	1.6	65	11.7	4	.6	2	11.1	359	11.5
Asia, Oceania	582	50.1	31	9.5	50	13.0	92	16.6	118	17.7	2	11.1	875	28.1
Africa	45	3.9	10	3.0		.1	8	1.4	2	.3			65	2.1
Total	1161	37.3	330	10.6	387	12.4	553	17.8	663	21.3	18	.57	3113	100.0

Source Foreign Trade of U S, 1923, pp 36, 37, 40

TABLE 23.—VALUES OF IMPORTS AND EXPORTS AND ESTIMATED VALUE OF PRODUCTION OF FOODSTUFFS IN COUNTRIES NAMED

(From Farmers' Bulletin 641, U. S. Dept. of Agr.)

The status of the United States in food supply will be a surprise to many. [Figures represent approximately conditions in 1912 or 1913. Values for the different countries are made independently of each other—i. e., on different bases—and therefore are not strictly comparable with each other.]

Product	United Kingdom: Millions of dollars			United Kingdom: Per cent production to requirements	France: Millions of dollars			France: Per cent production to requirements	Russia: Millions of dollars			Russia: Per cent production to requirements
	Imports	Exports	Production		Imports	Exports	Production		Imports	Exports	Production	
Edible grain	311	25	107	27	52	8	590	93	16	298	1477	124
Meats	326	19	350	53	31	23	540	98	13	7	876	99
Dairy products	151	5	243	62	13	16	193	101	1	38	412	110
Poultry and eggs	53		73	58	12	2	39	80		49	309	119
Vegetables	29		292	91	2	11	251	104	1	21	515	104
Fruits and nuts	87		24	22	13	14	58	102	21	3	77	81
Sugar	112			0	26	18	77	91		34	140	132
Coffee and tea	83	24		0	43			0	35		1	1
Fish	21	44	49	166	15	6	27	73	15	2	154	92
Other	63	83	24	540	25	11	2	13			25	100
Total	1239	200	1162	53	232	109	1777	93	102	452	3986	110

Product	Germany: Imports	Germany: Exports	Germany: Production	Germany: Per cent production to requirements	Austria-Hungary: Imports	Austria-Hungary: Exports	Austria-Hungary: Production	Austria-Hungary: Per cent production to requirements	Belgium: Imports	Belgium: Exports	Belgium: Production	Belgium: Per cent production to requirements
Edible grain	211	53	730	82	19	11	658	99	183	35	47	24
Meats	63		833	93	6	6	223	100	11	4	30	81
Dairy products	28		333	92	6	1	203	98	8	1	22	76
Poultry and eggs	53		107	67	15	32	122	115	5	3	8	80
Vegetables	13	5	714	99	6	6	424	100	15	17	77	103
Fruits and nuts	54	2	48	48	15	6	49	84	5	1	15	79
Sugar		62	143	177		52	90	230		12	19	272
Coffee and tea	54			0	68			0	15	5		0
Fish				0	4	1	4	53	5	1	7	63
Other	222	160	21	28	5		41	88				
Total	698	282	2932	88	144	115	1814	98	247	79	225	57

Product	Argentina: Imports	Argentina: Exports	Argentina: Production	Argentina: Per cent production to requirements	Canada: Imports	Canada: Exports	Canada: Production	Canada: Per cent production to requirements	United States: Imports	United States: Exports	United States: Production	United States: Per cent production to requirements
Edible grain	3	101	163	249	6	141	210	229	19	160	766	123
Meats	4	66	234	136	6	15	120	108	40	118	1986	106
Dairy products	2	2	26	100	2	21	172	112	16	147	800	120
Poultry and eggs				100	3		50	94	4	4	650	100
Vegetables	1		17	95	4	2	70	97	20	11	554	99
Fruits and nuts	2		7	78	17	5	20	62	48	31	250	94
Sugar	2		22	92	18		1	5	217	4	69	24
Coffee and tea	2			0	9			0	130			0
Fish	1				3	20	35	194	20	11	148	96
Other					4		2	33	48	18	111	79
Total	17	169	469	148	72	201	710	123	562	540	5334	100

TABLE 24.—THE FOOD OF NATIONS—FROM THE WORLD'S FOOD RESOURCES BY J. RUSSELL SMITH

World Crop Comparisons for the Three-Year Period, 1911–13

Careful study of this table will do much to explain the differences in the wealth of nations, especially the total tables showing grain and animals per capita, and the second column, population per square mile of improved land.

	Pop per Sq Mi	Pop per Sq Mi of Improved Land	Wheat		Rye		Potato		Corn		Barley		Oats		Total Grain per Cap	Cattle per 100 Pop	Sheep, Goats per 100 Pop	Swine per 100 Pop	Horses, Mules, Asses per 100 Pop
			Bu per Cap	Yield per Acre	Bu per Cap	Yield per Acre	Bu per Cap	Yield per Acre	Bu per Cap	Yield per Acre	Bu per Cap	Yield per Acre	Bu per Cap	Yield per Acre					
United States	26.6	222	7.5	14.7	.4	17.8	3.7	102	28.5	24.8	2.1	25.8	12.2	30.5	j50.8	a65.5	a60	a67.6	a70.2
Canada	1.9	124.8	32.7	21.4	.3	15.9	11.1	163	2.5	59	6.7	30.5	5.5	38.7	47.7	97	32	41.5	30
British Australasia	1.5	195	33.3	13.7	.04	14.8	4.9	121	2.6	28.9	.9	25.8	6.2	25	43	30.4	2401	29.6	65.7
Argentina	6.9	84	21.5	10.3			4.8	139	21	31			9.7	29.9	34.9	360	1074.5	37	123.7
Netherlands	504	1020	.8	35.3	2.6	27.7	21.3	304			.5	50.1	2.8	50.8	6.7	b34.4	b10.8	b21.7	b5.2
Belgium	652	1200	2.3	38.9	3.2	34.6	16.2	292			.6	51.4	5.4	63	11.5	25		17.5	3
Denmark	178	495	2	37.1	9.2	28.8	18	238			8.2	37.7	1.5	42.3	20.9	c89	c10.9	c71.3	c4.8
Germany	310.4	637	2.5	33.1	7.1	29.6	26.5	206			2.5	42.2	9.3	54.7	21.4	d31.6	d16	d35.9	d7.2
Hungary	166	368	8.3	19.9	2.4	24.8	9	180	7.9	27.7	3.7	27	6.6	33.2	28.9	f28.8	f35.6	f31.8	f10.4
Russia in Europe	70	302	5.3	10	7.2	12.7	9.3	114	1.9	19.6	1.6	16.6	2.1	21.9	18.1	g28.1	g35.4	g9.7	g18.9
United Kingdom	375.		1.3	32.2	.02	21	5.8	259			1.4	34	4	44.5	6.7	g26	g64.5	g8.5	g5.5
France	189.5	404	8.3	30.2	1.2	18.8	12.8	128	.5	21	1.1	25.5	7.9	31.2	19	35.3	44.6	17.4	8.3
Italy	326.5	433	4.6	12.5	1.4	16.5	1.8	97	2.9	25	.27	16	1	29.9	10.2	h17.9	h40.1	h7.2	h6.2
Spain	102.6	465	6.1	13.2	1.2	12.6	4.5	145	1.3	26.5	3.5	20.6	1.2	21	13.3	12.8	94	12.6	11.3
Japan	206	2572	.5	26.5			4.6	147	.6	25.3	1.7	28.8			j5	2.6	.2	.5	2.9
British India	223	744	1.5	12.2											j15.9	47.2	24.6	i7.5	1.3
Saskatchewan	1.9		33.8	21.1	.1	27.2	2.1	173			5.7	31.9	2	40.9	41.6	125	22.9	45.8	91
Prince Edward Island	42.9	78.6	6.4	19.1			66	171			1.4	28.5	66.9	34.9	78.0	118	107	47.2	37.1

a Data for 1910, 1912, 1913
b Data for 1910, 1913, 1915
c Data for 1909, 1914, 1915
d Data for 1907, 1912, 1913
e Data for 1911, 1912
f Data for 1911, 1913
g Data for 1910, 1911, 1912
h Data for 1908
i Buffaloes
j Including Rice

TABLE 25. — FOOD VALUES — FROM INDUSTRIAL AND COMMERCIAL GEOGRAPHY BY J RUSSELL SMITH

(Figures from U S Department of Agriculture)

	Refuse	Water, percent	Protein, percent	Fat, percent	Carbohydrates, percent	Fuel value per pound, calories
White bread		35.3	9.2	1.3	53.1	1,200
Wheat flour, patent roller process, high grade and medium		12.0	11.4	1.0	75.1	1,685
Wheat flour, entire wheat		11.4	13.8	1.9	71.9	1,675
Rye flour		12.9	6.8	0.9	78.7	1,620
Corn meal		12.5	9.2	1.9	75.4	1,635
Rice		12.3	8.0	0.3	79.0	1,620
Beans, dried		12.6	22.5	1.8	59.6	1,520
Beans, baked		68.9	6.9	2.5	19.6	555
Potatoes	20.0	62.6	1.8	0.1	14.7	295
Sweet potatoes	20.0	55.2	1.4	0.6	21.9	440
Bananas	35.0	48.9	0.8	0.4	14.3	260
Apples	25.0	63.3	0.3	0.3	10.8	190
Almonds	45.0	2.7	11.5	30.2	9.5	1,515
Chestnuts, fresh	16.0	37.8	5.2	4.5	35.4	915
Coconuts	48.8	7.2	2.9	25.9	14.3	1,295
Peanuts	24.5	6.9	19.5	29.1	18.5	1,775
Chocolate		5.9	12.9	48.7	30.3	2,625
Dates	10.0	13.8	1.9	2.5	70.6	1,275
Sirloin steak	12.8	54.0	16.5	16.1		975
Neck of beef	27.6	45.9	14.5	11.9		1,165
Cod, salt	24.9	40.2	16.0	0.4		325
Salmon (canned)		63.5	21.8	12.1		915
Eggs, hens' eggs	11.2	65.5	13.1	9.3		635
Whole milk		87.0	3.3	4.0	5.0	310
Cheese, full cream		34.2	25.9	33.7	2.4	1,885
Butter		11.0	1.0	85.0		3,410
Oleomargarine		9.5	1.2	83.0		3,525
Unrefined lard		4.8	2.2	94.0		4,010
Pure olive oil Pure coconut oil Pure peanut oil Pure cottonseed oil				100.0		4,040

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